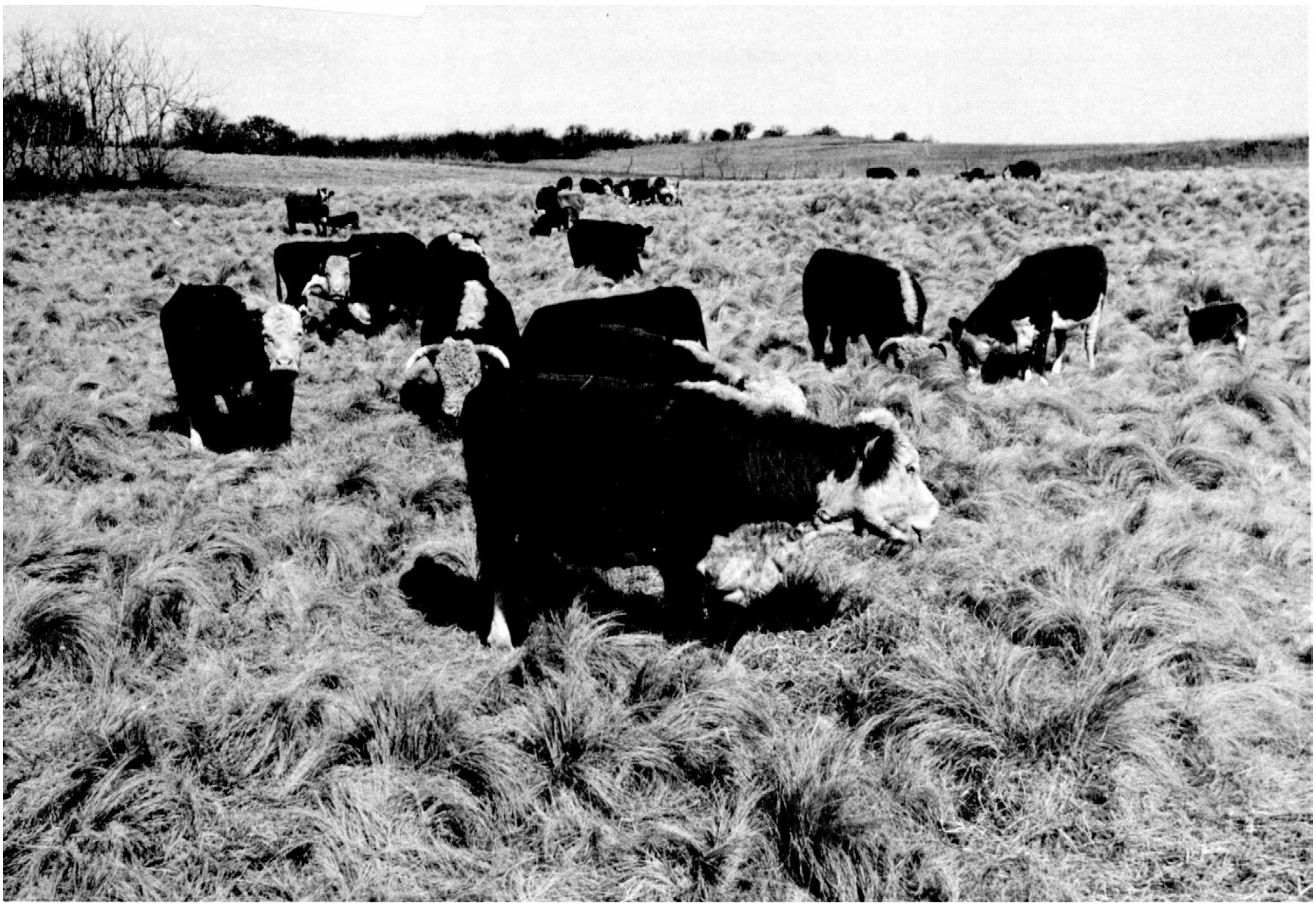
SOIL SURVEY OF

Caddo County, Oklahoma



United States Department of Agriculture
Soil Conservation Service
In cooperation with
Oklahoma Agricultural Experiment Station

Issued April 1973

Major fieldwork for this soil survey was done in the period 1958–65. Soil names and descriptions were approved in 1967. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1965. This survey was made cooperatively by the Soil Conservation Service and the Oklahoma Agricultural Experiment Station. It is part of the technical assistance furnished to the North Caddo County Soil and Water Conservation District and the South Caddo County Soil and Water Conservation District. Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, USDA, Washington, D.C. 20250

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Caddo County are shown on the detailed soil map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the capability unit, range site, and woodland suitability group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, range sites, and woodland groups.

Foresters and others can refer to the section "Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Ranchers and others can find, under "Range Management," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of Soils."

Newcomers in Caddo County will be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication and in the section "General Nature of the County."

Cover picture: **Weeping lovegrass on a Cobb fine sandy loam provides forage for cattle and helps to protect the soil from blowing.**

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Contents

SOIL SURVEY OF CADDO COUNTY, OKLAHOMA

By HAMILTON H. MOFFATT, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE OKLAHOMA AGRICULTURAL EXPERIMENT STATION

CADDO COUNTY is in the west-central part of Oklahoma (fig. 1). It has an area of approximately 808,320 acres, or 1,263 square miles. Anadarko, the county seat, is in the east-central part of the county. The elevation of the county ranges from 1,130 feet in the southeast to 1,718 feet in the northwest. At the county courthouse in Anadarko the elevation is 1,273 feet above sea level.

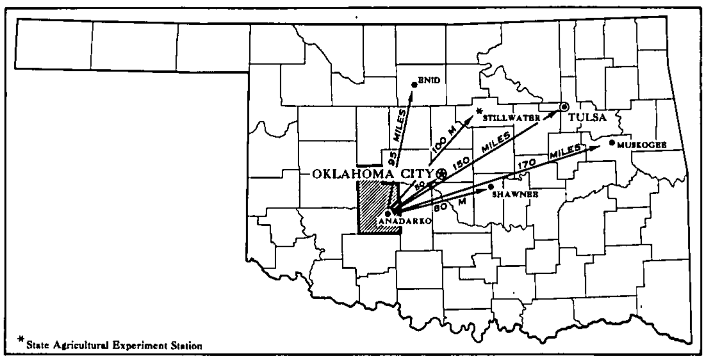

Figure 1.—Location of Caddo County in Oklahoma.

In this county most of the income comes from the sale of farm products. The major part of the income is from the sale of crops, and the rest is from livestock and livestock products. Peanuts, wheat, cotton, grain sorghum, and hay crops are the main crops.

Most of the soils in the county are deep, nearly level to sloping, and loamy. About 90 percent of the county is made up of soils on uplands, and the remaining 10 percent consists of soils on bottom lands.

On prairie uplands the soils are level to gently sloping, deep, and loamy. These soils are among the best soils in the county for farming. The soils on uplands under trees are deep and sandy to loamy or are shallow to sandstone and rolling to hilly. These soils are susceptible to soil blowing.

Small grains grow well on the deep, slowly permeable or very slowly permeable soils on prairie uplands. The soils that are shallow to limestone and that are shallow to sandstone generally are better suited to range than to other uses. The well-drained, loamy and sandy soils on bottom lands are cultivated, but the poorly drained soils in such areas have a high water table and are used mainly for pasture. Most of the soils in Caddo County respond if fertilizer is applied.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Caddo County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kind of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plants roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Cyril and Pond Creek, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Cobb fine sandy loam, 1 to 3 percent slopes, is one of several phases within the Cobb series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Three such kinds of mapping units are shown on the soil map of Caddo County: soil complexes, soil associations, and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Quinlan-Woodward complex, 5 to 12 percent slopes, is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Darnell-Noble association, rolling, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Cobb and Grant soils, 3 to 8 percent slopes, severely eroded, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Rough broken land is a land type in Caddo County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Caddo County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The eight soil associations in Caddo County are discussed in the following pages. More detailed information about the individual soils in each association can be obtained from the detailed soil map and from the section, "Descriptions of the Soils."

1. Port-Gracemont-Pulaski Association

Deep, loamy and sandy, nearly level soils on flood plains

This association consists of deep, nearly level soils on flood plains throughout the county. Most areas are flooded once in 5 to 20 years, but some areas are flooded more than once each year.

The soils of this association occupy about 71,000 acres, or 8.8 percent of the county. About 37 percent is made up of Port soils, 20 percent of Gracemont soils, and 18 percent of Pulaski soils. The remaining 25 percent consists of minor soils.

Port soils are loamy, are well drained, and are moderately permeable. Gracemont soils are loamy and sandy and are somewhat poorly drained. They have moderately rapid permeability and have a water table at a depth of less than 40 inches. Pulaski soils, which are sandy and loamy and are well drained, have moderately rapid permeability.

Minor soils in this association are in the Cyril, McLain, Miller, Reinach, and Yahola series.

The farms of this association are smaller than those in the other associations in the county. Most of the acreage is cultivated, and alfalfa, small grains, cotton, peanuts, and grain sorghum are the main crops. Some areas are used for tame pasture. Others are used as native range, as woodland, and as wildlife areas. Some of the soils are irrigated. Sprinkler systems are commonly used to provide irrigation water, though a flooding system is used on a few farms. Streams are the main source of irrigation water.

Maintaining soil structure and fertility, protecting the soils from flooding, and providing subsurface drainage where the water table is high are the chief concerns of management. Response to management is favorable.

2. Pond Creek-Minco Association

Deep, loamy, nearly level to steep soils on uplands

This association consists of nearly level to steep soils on uplands. The areas are broad and are cut by narrow, steep drainageways.

The soils of this association occupy about 75,000 acres, or 9.3 percent of the county. About 36 percent is made up of Pond Creek soils, 34 percent of Minco soils, and the remaining 30 percent of the minor soils.

Pond Creek soils are nearly level and very gently sloping and have moderately slow permeability. Minco soils are mostly gently sloping and sloping, but a small acreage is moderately steep or steep and is cut by drainageways. These soils are moderately permeable.

Minor soils in this association are in the Dill, Lucien, Quinlan, Reinach, and Woodward series. The land type Rough broken land is also in this association.

Most areas of this association are cultivated. The main crops are small grains, grain sorghum, alfalfa, cotton, and peanuts. A small acreage is used for tame pasture, native range, woodland, and wildlife. A large number of beef cattle also are raised in this association, as well as some dairy cattle.

Maintaining soil structure and fertility and controlling erosion are the chief concerns of management. Response to management is favorable.

3. Pond Creek-Cobb Association

Deep and moderately deep, loamy, nearly level to sloping soils on uplands

This association consists of loamy, nearly level to sloping soils on uplands that are cut by narrow drainageways.

The soils of this association occupy about 165,000 acres, or 20.4 percent of the county. About 28 percent is made up of Pond Creek soils, 26 percent of Cobb soils, and the remaining 46 percent of the minor soils.

Pond Creek soils are deep and are nearly level or very gently sloping and have moderately slow permeability. Cobb soils are moderately deep, are very gently sloping to sloping, and are moderately permeable.

Minor soils are in the Darnell, Dill, Gracemont, Grant, Lucien, Minco, Noble, Port, Pulaski, Quinlan, Reinach, Shellabarger, Woodward, and Yahola series.

Most of the acreage of this association is cultivated. The main crops are peanuts, cotton, small grains, grain sorghum, and alfalfa. Beef cattle are raised on most of the farms. Some areas of these soils are used for tame pasture, native range, woodland, and wildlife. Most of the irrigated soils in the county are in this association. Sprinklers are commonly used to apply irrigation water, and wells are the main source of water. Some landowners, however, obtain irrigation water from farm ponds, streams, or flood control structures.

Maintaining soil structure and fertility and controlling erosion are the chief concerns of management. Response to management is favorable.

4. Grant-Pond Creek-Lucien Association

Deep and shallow, loamy, nearly level to steep soils on uplands

In this association are nearly level to steep soils on uplands. These soils occupy about 176,320 acres, or 21.9 percent of the county. About 25 percent of the association is made up of Grant soils, 25 percent of Pond Creek soils, and 17 percent of Lucien soils. The remaining 33 percent consists of minor soils.

Grant soils are deep, are very gently sloping to sloping, and are moderately permeable. Pond Creek soils are also deep, but they are nearly level or very gently sloping and have moderately slow permeability. Lucien soils are mapped only in complexes with Dill soils. They are shallow and have moderately rapid permeability. The Dill soils, however, are moderately deep and have moderately rapid permeability.

Minor soils in this association are in the Acme, Cobb, Grant, Norge, Port, Pulaski, Quinlan, Wing, and Woodward series. In addition gypsum crops out in small areas.

Most of the acreage of this association is cultivated. The main crops are small grains, cotton, grain sorghum, peanuts, and alfalfa. Some areas are used for tame pasture, native range, woodland, and wildlife.

Diversified farming is practical on the soils of this association. Most landowners raise beef cattle to supplement their farm income. On a few farms the raising of livestock is the chief enterprise, though some cultivated crops are grown.

Maintaining soil structure and fertility and controlling water erosion are the chief concerns of management. Response to management is favorable.

5. Dougherty-Eufaula Association

Deep, sandy, very gently sloping to rolling soils on uplands

This association consists of very gently sloping to rolling soils on uplands. These soils occupy about 68,000 acres, or about 8.4 percent of the county. About 39 percent is made up of Dougherty soils, 38 percent of Eufaula soils, and the remaining 23 percent of the minor soils.

Dougherty soils are very gently sloping to sloping and are moderately permeable. Eufaula soils are very gently sloping to rolling and are rapidly permeable.

Minor soils in this association are in the Cobb, Darnell, Konawa, and Noble series.

Most of the acreage of these soils is cultivated. The main crops are grain sorghum, cotton, peanuts, and small grains. Some areas are used for tame pasture, native range, woodland, and wildlife. Most of this association is used for general farming, but livestock are raised on a few farms for supplemental income.

Some areas in this association are irrigated, and wells are the main source of water. Maintaining soil fertility and controlling erosion are the chief concerns of management. Response to management is favorable.

6. Noble-Darnell Association

Deep and shallow, loamy, very gently sloping to hilly soils on uplands

In this association are very gently sloping to hilly soils in wooded uplands. These soils occupy about 182,000 acres,

or about 22.4 percent of the county. About 60 percent of the association is made up of Noble soils, 27 percent of Darnell soils, and the remaining 13 percent of the minor soils.

Noble soils are deep and are very gently sloping to hilly, but Darnell soils are shallow and are gently sloping to hilly. In both soils permeability is moderately rapid.

Minor soils in this association are in the Cobb, Dougherty, and Eufaula series.

Most of the acreage of this association is used as range, chiefly for beef cattle. Some soils are cultivated, and the main crops are small grains, grain sorghum, alfalfa, cotton, and peanuts. Some soils in the association are used for tame pasture, woodland, and wildlife.

Maintaining soil structure and fertility and controlling erosion are the chief concerns of management.

7. Tillman-Hollister-Foard Association

Deep, loamy, nearly level to gently sloping soils underlain by loamy or clayey material; on uplands

The soils in this association occupy about 60,000 acres, or 7.4 percent of the county. About 56 percent is made up of Tillman soils, 12 percent of Hollister soils, and 11 percent of Foard soils. The remaining 21 percent consists of minor soils.

Tillman soils are very gently sloping or gently sloping and are very slowly permeable. Hollister soils are nearly level and are slowly permeable. Foard soils are also nearly level, but they are very slowly permeable.

Minor soils in this association are in the Vernon series. The land types Limestone cobbly land and Breaks are also in this association.

Most of the acreage of these soils is cultivated. The farms and ranches are larger than in the other associations in the county. The main crops are wheat and other small grains, grain sorghum, cotton, and alfalfa. Large numbers of cattle are raised. Some of the soils are used for native range, woodland, and wildlife. Nearly all of the minor soils are in native range.

Maintaining soil structure, increasing the intake of water, and controlling water erosion are the chief concerns of management.

8. Talpa-Rock Outcrop Association

Very shallow, loamy, sloping to steep soils and limestone rock on uplands

The soils of this association occupy about 11,000 acres, or 1.4 percent of the county. About 76 percent of the association is made up of Talpa soils, 19 percent of Rock outcrop, and the remaining 5 percent of minor soils.

Talpa soils are very shallow, loamy, and sloping to steep. They are moderately permeable. Limestone rock crops out at an angle of about 45 degrees. These rock outcrops are 6 inches to 2 feet high, 1 to 3 feet wide, and several hundred feet long. They lie in the direction of the slope and give the effect of rows of edgerock. The rows are 4 to 8 feet apart, and Talpa soils are between the rows.

Minor areas in this association consist of the land types Breaks and Limestone cobbly land.

All of the acreage of this association is used as native range. Cattle ranching is dominant. The size of the ranching units is larger than those units that are used primarily for general farming.

Maintaining a good cover of permanent vegetation and controlling water erosion are the chief concerns of management.

Descriptions of the Soils

This section describes the soil series and the mapping units of Caddo County in alphabetic order. The procedure is first to describe the soil series, and then the mapping units in that series. Thus to get full information on any one mapping unit, it is necessary to read the description of that unit and also the description of the series to which it belongs.

The description of a soil series mentions features that apply to all the soils in a series. Differences among the soils of one series are pointed out in the description of the individual soils or are indicated in the soil name. As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Breaks, for example, is a miscellaneous land type that does not belong to a soil series. It is listed, nevertheless, in alphabetic order along with the soil series.

Each series contains a short description of a representative soil profile and a much more detailed description of the same profile that scientists, engineers, and others can use in making highly technical interpretations. In the technical description, the color of each layer, or horizon, is given in words, such as yellowish brown, and is also indicated by symbols for hue, value, and chroma, such as 10YR 5/4. These symbols, called Munsell color notations, are used to evaluate the color of the soil precisely (*5*) [1]. Unless otherwise stated all color terms are for dry soil.

Following the name of each mapping unit, there is a symbol in parentheses. The symbol identifies the mapping unit on the detailed map. Listed at the end of each description of a mapping unit is the capability unit, the range site, and the woodland suitability group in which the mapping unit has been placed. The pages on which each is described can be found by referring to the "Guide to Mapping Units" at the back of this survey.

Many of the terms used to describe the soils are defined in the Glossary at the back of this survey. For more general information about the soils, the reader can refer to the section "General Soil Map," where broad patterns of the soils are described. The approximate acreage and proportionate extent of the soils are given in table 1, and their location and extent are shown on the detailed map at the back of this survey.

Acme Series

The Acme series consists of very gently sloping to sloping soils that are shallow over gypsum. These soils formed on uplands under a cover of short and mid grasses.

In a representative profile the surface layer is dark-brown, mildly alkaline silt loam to a depth of about 8 inches and brown, calcareous silt loam that is moderately alkaline to a depth of 15 inches. Below is white crystalline gypsum.

[1] Italic numbers in parentheses refer to Literature Cited, p. 68.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent	Soil	Acres	Percent
Acme-Gypsum outcrop complex, 2 to 8 percent slopes	4,480	0.6	Minco silt loam, 3 to 5 percent slopes	12,220	1.5
Breaks	9,840	1.2	Minco very fine sandy loam, 3 to 8 percent slopes	32,760	4.1
Cobb fine sandy loam, 1 to 3 percent slopes	12,150	1.5	Minco very fine sandy loam, steep	4,500	.6
Cobb fine sandy loam, 3 to 5 percent slopes	21,790	2.7	Noble fine sandy loam, 1 to 3 percent slopes	13,870	1.7
Cobb fine sandy loam, 5 to 8 percent slopes	3,910	.5	Noble fine sandy loam, 3 to 8 percent slopes	74,260	9.2
Cobb fine sandy loam, 3 to 8 percent slopes, eroded	19,530	2.4	Norge silt loam, 1 to 3 percent slopes	12,130	1.5
Cobb and Grant soils, 3 to 8 percent slopes, severely eroded	15,920	2.0	Norge silt loam, 3 to 5 percent slopes	13,370	1.7
Cyril fine sandy loam	2,550	.3	Pond Creek silt loam, 0 to 1 percent slopes	16,780	2.1
Cyril fine sandy loam, noncalcareous variant	740	.1	Pond Creek silt loam, 1 to 3 percent slopes	38,470	4.7
Darnell-Noble association, rolling	61,740	7.6	Pond Creek silt loam, 1 to 3 percent slopes, eroded	1,980	.2
Darnell-Noble association, hilly	17,440	2.2	Pond Creek fine sandy loam, 0 to 1 percent slopes	7,540	.9
Darnell soils, 3 to 12 percent slopes, severely eroded	5,040	.6	Pond Creek fine sandy loam, 1 to 3 percent slopes	40,310	5.0
Dougherty loamy fine sand, 1 to 3 percent slopes	11,850	1.5	Port silt loam	27,040	3.4
Dougherty and Eufaula loamy fine sands, 3 to 8 percent slopes	31,750	3.9	Port and Pulaski soils, channeled	2,670	.3
Eufaula fine sand, rolling	10,100	1.3	Pulaski soils	13,080	1.6
Eufaula loamy fine sand, 1 to 3 percent slopes	1,180	.2	Quinlan-Woodward complex, 5 to 12 percent slopes	25,380	3.1
Eufaula loamy fine sand, hummocky	740	.1	Reinach silt loam, 0 to 1 percent slopes	12,030	1.5
Foard silt loam, 0 to 1 percent slopes	7,010	.9	Reinach silt loam, upland, 0 to 1 percent slopes	740	.1
Gracemont soils	14,820	1.8	Reinach silt loam, upland, 1 to 3 percent slopes	17,000	2.1
Grant loam, 1 to 3 percent slopes	15,520	1.9	Rough broken land	8,820	1.1
Grant loam, 3 to 5 percent slopes	19,390	2.4	Shellabarger fine sandy loam, 1 to 3 percent slopes	3,810	.5
Grant loam, 3 to 6 percent slopes, eroded	5,160	.6	Shellabarger fine sandy loam, 3 to 5 percent slopes	2,710	.3
Grant loam, 5 to 8 percent slopes	2,890	.4	Talpa-Rock outcrop complex, 5 to 30 percent slopes	10,960	1.4
Grant-Wing complex, 1 to 5 percent slopes	2,810	.3	Tillman silty clay loam, 1 to 3 percent slopes	22,840	2.8
Hollister silt loam, 0 to 1 percent slopes	7,440	.9	Tillman silty clay loam, 3 to 5 percent slopes	9,100	1.1
Konawa loamy fine sand, 1 to 5 percent slopes, eroded	6,500	.8	Tillman silty clay loam, 2 to 5 percent slopes, eroded	1,910	.2
Konawa soils, 2 to 8 percent slopes, severely eroded	2,500	.3	Vernon soils, 5 to 12 percent slopes	1,160	.1
Limestone cobbly land	5,510	.7	Woodward-Quinlan complex, 3 to 5 percent slopes	9,960	1.2
Lucien-Dill fine sandy loams, 3 to 12 percent slopes	33,900	4.2	Yahola soils	5,860	.7
Lucien-Dill fine sandy loams, 12 to 30 percent slopes	4,600	.6			
McLain silty clay loam	4,820	.6	Total land area plus lakes of less than 40 acres	808,320	100.0
Miller silty clay loam	1,440	.2			

Acme soils are well drained and are moderately permeable. Available water capacity is low, and intake rate is moderate.

Representative profile of Acme silt loam from an area of Acme-Gypsum outcrop complex, 2 to 8 percent slopes, in native range (230 feet south and 100 feet east of the northwest corner of sec. 33, T. 7 N., R. 11 W.):

A11—0 to 8 inches, dark-brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; moderate, medium, granular structure; slightly hard, friable; many roots; mildly alkaline; calcareous; gradual, smooth boundary.

A12—8 to 15 inches, brown (7.5YR 5/2) silt loam, dark brown (7.5YR 3/2) moist; moderate, medium, granular structure; hard, friable; the lower part is about 3 percent fine gypsum particles; moderately alkaline; calcareous; abrupt, wavy boundary.

R—15 inches, white (N 8/0) crystalline gypsum; massive; very hard; darkened stains in natural openings and crevices of upper 3 inches.

The A horizon is clay loam, loam, or silt loam. It ranges from dark brown through grayish brown in hues of 7.5YR and 10YR. Reaction is mildly alkaline or moderately alkaline, and the A horizon is calcareous. The underlying gypsum ranges from a few feet to more than 15 feet in thickness. It ranges from white to gray in color.

Acme soils are underlain by gypsum at a depth between 10 and 20 inches. They are the only soils mapped in the county that formed in material weathered from gypsum.

Acme-Gypsum outcrop complex, 2 to 8 percent slopes (AgD).—This complex consists chiefly of Acme silt loam, on side slopes below the crest of hills, and of gypsum outcrops on hilltops and the sides of hills. The Acme part makes up 50 to 70 percent of this complex; the Gypsum outcrop part, from 15 to 35 percent. The remaining 5 to 20 percent consists of a soil similar to the Acme but that has gypsum at a depth between 20 and 36 inches. The Acme soil has the profile described as representative of the Acme series.

Nearly all areas of this complex are used as range. Both parts in capability unit VIIs-1, dryland, and in woodland suitability group 4; Acme part in Loamy Prairie range site, and Gypsum outcrop in Gyp range site.

Breaks

Breaks (Bk) consists of moderately deep to deep, loamy soils on uplands along drainageways. The areas are long

and are between 100 and 700 feet wide. They consist of soil material on side slopes and of alluvial material between the side slopes. The composition of the soils in this unit is more variable than that of the others in the county but has been controlled well enough for the expected use of the soils.

The material on side slopes is moderately deep to deep, loamy, and grayish brown to reddish brown. Slopes range from 5 to 20 percent. The areas on the side slopes make up 70 to 80 percent of the acreage of this unit. The deep alluvial material between the side slopes is loamy to clayey and grayish brown to reddish brown. Slopes here are 0 to 3 percent. This material occupies 15 to 25 percent of the unit.

In some areas slick spots are common, but they occupy no more than 10 percent of any one area.

On the side slopes the vegetation ranges from short to tall native grasses. Mid grasses are dominant on the loamy soils. On the alluvial material the vegetation is mostly tall grasses and deciduous trees. Capability unit VIe–1, dryland; Loamy Prairie range site; woodland group 3.

Cobb Series

The Cobb series consists of moderately deep, very gently sloping to sloping soils on uplands. These soils formed under a cover of mid and tall grasses and scattered trees.

In a representative profile the surface layer is reddish-brown fine sandy loam about 8 inches thick. Below this is sandy clay loam, about 33 inches thick, that is reddish brown in the upper part and red in the lower part. The underlying material is reddish sandstone.

These soils are well drained and moderately permeable. Available water capacity is high, and intake rate is moderate.

Representative profile of Cobb fine sandy loam, 1 to 3 percent slopes, in a cultivated field (2,550 feet west and 140 feet south of the northeast corner of sec. 17, T. 7 N., R. 13 W.):

Ap—0 to 8 inches, reddish-brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak, fine, granular structure; slightly hard, friable; slightly acid; clear, smooth boundary.

B21t—8 to 20 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; weak, coarse, prismatic structure that parts to weak, medium, subangular blocky; hard, friable; sand grains coated and bridged; patchy clay films on ped faces; slightly acid; gradual, smooth boundary.

B22t—20 to 41 inches, red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; weak, coarse, prismatic structure that parts to weak and moderate, medium, subangular blocky; very hard, friable; discontinuous clay films on vertical faces of peds; neutral; gradual, wavy boundary.

R1—41 to 54 inches, red (2.5YR 5/6), weakly cemented sandstone, dark red (2.5YR 3/6) moist; massive; slightly hard, friable; gradual, wavy boundary.

R2—54 to 66 inches, red (2.5YR 5/6), weakly cemented sandstone, red (2.5YR 4/6) moist; massive; very hard, firm.

The A horizon generally is fine sandy loam. It is loamy fine sand in winnowed areas, however, and is less than 5 inches thick. Its color ranges from dark brown to reddish brown in hues of 7.5YR and 5YR. Reaction is slightly acid or neutral. The Bt horizon is fine sandy loam or sandy clay loam. It ranges from dark reddish brown to reddish gray in hues of 2.5YR and 5YR. Reaction is slightly acid or neutral. In a few areas soft white spots and streaks of calcium carbonate occur just above the sandstone.

Cobb soils have a redder, more sandy B horizon than that in Grant and Pond Creek soils. Depth to sandstone is less than in Shellabarger soils and greater than in Lucien soils.

Cobb fine sandy loam, 1 to 3 percent slopes (CoB).—This very gently sloping soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Darnell fine sandy loam, Dill fine sandy loam, Lucien fine sandy loam, Noble fine sandy loam, and Pond Creek fine sandy loam. Also included are small areas of Grant loam.

This soil is used mainly for such cultivated crops as small grains, grain sorghum, alfalfa, cotton, and peanuts. Some areas are used for tame pasture or native range, and some areas are irrigated. Capability unit IIe–2, dryland, and IIe–1, irrigated; Sandy Prairie range site; woodland suitability group 2.

Cobb fine sandy loam, 3 to 5 percent slopes (CoC).—This gently sloping soil is on the sides and tops of hills in the uplands.

Included with this soil in mapping are small areas of Dill fine sandy loam, Lucien fine sandy loam, and Noble fine sandy loam. Also included are small areas of Grant loam.

This soil is used mainly for small grains, grain sorghum, alfalfa, cotton, and peanuts. Some areas are used for tame pasture or native range, and some areas are irrigated. Capability unit IIIe–2, dryland, and IIIe–1, irrigated; Sandy Prairie range site; woodland suitability group 2.

Cobb fine sandy loam, 5 to 8 percent slopes (CoD).—This sloping soil is on the sides and tops of hills in the uplands.

Included with this soil in mapping are small areas of Dill fine sandy loam, of Grant loam, of Lucien fine sandy loam, and of Noble fine sandy loam.

About half of the acreage of this soil is cultivated. The main crops are small grains, peanuts, grain sorghum, and cotton. Some areas are used for native range or tame pasture, and some areas are irrigated. Capability unit IVe–3, dryland, and IVe–1, irrigated; Sandy Prairie range site; woodland suitability group 3.

Cobb fine sandy loam, 3 to 8 percent slopes, eroded (CoD2).—This gently sloping to sloping soil is on the sides and tops of hills. Part of the original surface layer has been removed by erosion. The present surface layer is a mixture of the remaining surface layer and of material formerly in the underlying layers. Rills and shallow gullies are common.

Included with this soil in mapping are small areas of Dill fine sandy loam, of Lucien fine sandy loam, and of Noble fine sandy loam. Also included are small areas of outcrop of sandstone.

Most of this soil is cultivated and used for small grains, grain sorghum, peanuts, and cotton. Some areas are used for tame pasture or native range. Some areas are irrigated. Capability unit IVe–4, dryland, and IVe–1, irrigated; Sandy Prairie range site; woodland suitability group 3.

Cobb and Grant soils, 3 to 8 percent slopes, severely eroded (CrD3).—These gently sloping to sloping soils are on uplands, mainly on the sides and tops of hills near drainageways. Part of the original surface layer has been washed away, and the underlying layers are exposed in more than 25 percent of the area. Gullies and rills are common.

The Cobb part makes up about 65 percent of this unit, and the Grant part about 25 percent. Any one mapped

area may have, however, only one of these dominant soils. Noble soils and sandstone outcrops make up the remaining 10 percent. Except that the surface layer is 4 inches thinner, the Cobb part of this unit has a profile similar to that described as representative of the Cobb series. The profile of the Grant part is similar to that described as representative of the Grant series, but its surface layer is 3 inches thinner. Both parts in capability unit VIe–2, dryland, and in woodland suitability group 4; Cobb part in Sandy Prairie range site, and Grant part in Loamy Prairie range site.

Cyril Series

The Cyril series consists of deep, nearly level soils on flood plains. These soils formed under hardwoods and tall grasses in calcareous sediment.

In a representative profile the surface layer is dark grayish-brown fine sandy loam to a depth of about 12 inches and gray loam to a depth of 34 inches. Below this to a depth of 48 inches is light brownish-gray loam. Light-brown, calcareous loam is at a depth below 48 inches.

Cyril soils are subject to flooding. They are well drained and are moderately permeable. Available water capacity is high, and intake rate is moderate.

Representative profile of Cyril fine sandy loam, in a cultivated field (1,120 feet west and 90 feet south of the northeast corner of sec. 29, T. 7 N., R. 12 W.):

A11—0 to 12 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; moderate, fine and medium, granular structure; soft, very friable; calcareous; moderately alkaline; gradual, smooth boundary.

A12—12 to 34 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; weak, fine, granular structure; slightly hard, very friable; calcareous; a few concretions of calcium carbonate; moderately alkaline; gradual, smooth boundary.

B—34 to 48 inches, light brownish-gray (10YR 6/2) loam; dark grayish-brown (10YR 4/2) moist; weak, fine, granular structure; hard, friable; 1 to 2 percent calcium carbonate; coatings on ped surfaces and soft white spots; calcareous; moderately alkaline; gradual, smooth boundary.

C—48 to 60 inches, light-brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; massive; hard; friable; 3 to 5 percent cacium carbonate concretions; calcareous.

The A horizon generally is fine sandy loam or loam. Its color ranges from grayish brown to very dark gray in hue of 10YR. In places the A horizon is noncalcareous in the upper part. The B horizon ranges from very dark grayish brown to brownish yellow or from dark brown to reddish yellow. Texture of the B and C horizons is fine sandy loam, loam, or silt loam. A few to many spots and streaks of calcium carbonate are in the B and C horizons.

Cyril soils have a B horizon, which is lacking in Yahola soils. They have a calcareous surface layer, which is lacking in Pulaski and Port soils.

Cyril fine sandy loam (Cs).—This nearly level soil has the profile described as representative of the series. It is on flood plains, and the areas are flooded once in 5 to 20 years.

Included with this soil in mapping are a few large areas of Cyril fine sandy loam, noncalcareous variant. Also included are a few small areas of Pulaski soils and of a Noble fine sandy loam.

This Cyril soil is used mainly for such crops as cotton, small grains, peanuts, alfalfa, and grain sorghum, though some areas are used for tame pasture or native range. In some places the original stands of hardwoods remain. Capability unit IIw–1, dryland, and IIw–1, irrigated; Loamy Bottomland range site; woodland suitability group 1.

Cyril fine sandy loam, noncalcareous variant (Cy).—This nearly level soil is on flood plains of the Little Washita River. The areas are flooded once in 5 to 20 years.

This soil is noncalcareous in the upper 20 inches, but its profile otherwise is similar to that described as representative of the series.

Included with this soil in mapping are a few areas of Cyril fine sandy loam. Also included are small areas of Pulaski soils and of Noble fine sandy loam.

Most of the acreage of this Cyril soil is used for such crops as cotton, peanuts, grain sorghum, small grains, and alfalfa, but some areas are used for tame pasture or native range. In some places small stands of the original hardwoods remain. Capability unit IIw–1, dryland, and IIw–1, irrigated; Loamy Bottomland range site; woodland suitability group 1.

Darnell Series

The Darnell series consists of shallow, gently sloping to hilly soils on uplands. These soils formed under mid grasses and oak forest in material weathered from sandstone.

In a representative profile the surface layer is brown, slightly acid fine sandy loam about 6 inches thick. The next layer is light-brown, slightly acid fine sandy loam to a depth of 14 inches. The underlying material is sandstone.

Darnell soils are well drained. Permeability is moderately rapid. Available water capacity is low, and intake rate is high.

Representative profile of Darnell fine sandy loam from an area of Darnell-Noble association, rolling, in an oak forest (500 feet west and 100 feet north of the southeast corner of sec. 11, T. 6 N., R. 9 W.):

A1—0 to 6 inches, brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak, fine, granular structure; soft, very friable; slightly acid; gradual, smooth boundary.

B—6 to 14 inches, light-brown (7.5YR 6/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak, fine, granular structure; soft, very friable; slightly acid; clear, wavy boundary.

R—14 inches +, red (2.5YR 5/6) sandstone, red (2.5YR 4/6) moist; the sandstone is soft enough to break with an auger when moist but is very hard when dry; slightly acid.

The A horizon ranges from brown or dark grayish brown to pale brown in color. Reaction is medium acid through neutral. The B horizon ranges from reddish brown or brown to light brown in hues of 5YR through 7.5YR. Reaction is medium acid through neutral. Depth to sandstone ranges from 6 to 20 inches.

The Darnell soils are not so clayey throughout as the Vernon soils, and they are more acid throughout than the Quinlan soils. Unlike the Lucien soils, the Darnell soils have a dry value in the surface layer of 5.5 or higher, except where the surface layer is less than 7 inches thick, and here the value is less than 5.5.

Darnell-Noble association, rolling (DnD).—This mapping unit consists of rolling soils on uplands. Slopes range from 3 to 12 percent. The composition of the soils in this unit is more variable than that of others in the county but has been controlled well enough for the expected use of the soils.

The Darnell soil is on the sides and tops of ridges and makes up about 25 to 50 percent of the acreage of this mapping unit. The Noble soil is in swales between the

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ridges and makes up about 25 to 40 percent. A soil that is deeper than the Darnell but shallower than the Noble occurs on ridges and swales and makes up about 20 percent of the acreage.

Included with this soil in mapping are a few, small areas of Eufaula fine sand. Also included are small areas of soils similar to the Darnell soil but that have layers of sandy clay loam between the surface layer and the underlying sandstone.

The Darnell soils in this unit have the profile described as representative of the Darnell series, and the Noble soils, the profile described as representative of the Noble series.

Most of the acreage of this unit is used for native range, but some areas are used for tame pasture. Both parts in capability unit VIe-3, dryland, and in woodland suitability group 4; Darnell part in Shallow Savannah range site, and Noble part in Sandy Savannah range site.

Darnell-Noble association, hilly (DnE).—This mapping unit consists of hilly soils on uplands. Slopes range from 12 to 30 percent. The composition of these soils is more variable than that of the others in the county but has been controlled well enough for the expected use of the soils.

The Darnell soil in this unit has a surface layer that is 2 inches thinner than that in the profile described as representative of the Darnell series. The profile of the Noble soil is similar to that described as representative of the Noble series.

The Darnell soil, on the sides and tops of ridges, makes up about 25 to 50 percent of the acreage of this mapping unit. The Noble soil is in the swales between the ridges and makes up 25 to 40 percent. A soil that is deeper than the Darnell but shallower than the Noble occurs on ridges and swales and makes up about 20 percent of this unit.

Included with these soils in mapping are some areas of a soil that has a profile similar to that described as representative of the Darnell soil but that has sandy clay loam below the surface layer and above the sandstone. Also included are a few outcrops of sandstone.

Most areas of this unit are used for native range. Both parts in capability unit VIIe-2, dryland, and in woodland suitability group 4; Darnell part in Shallow Savannah range site, and Noble part in Sandy Savannah range site.

Darnell soils, 3 to 12 percent slopes, severely eroded (DaD3).—This mapping unit consists of gently sloping to strongly sloping soils on uplands. Much of the original surface layer has been washed away, and the underlying sandstone is exposed. Rills occur in places.

Included with these soils in mapping are a few areas of a soil that is similar to the Darnell soil but is more than 20 inches deep to sandstone. Also included are a few areas of sandstone outcrops.

Most of the acreage of these Darnell soils formerly was cultivated. The areas are now seeded to native grasses and used for native range. Capability unit VIIe-1, dryland; Eroded Shallow Savannah range site; woodland suitability group 4.

Dill Series

Dill soils are moderately deep aud gently sloping to steep. These soils are on uplands. They formed under mid and tall grasses in reddish material weathered from sandstone.

In a representative profile the surface layer is reddish-brown fine sandy loam about 12 inches thick. Between a depth of 12 and 30 inches is reddish-brown fine sandy loam that has prismatic structure. At a depth of more than 30 inches is red, fine-grained sandstone.

Dill soils are well drained. Permeability is moderately rapid. Available water capacity is high, and intake rate is moderate.

In this county Dill soils are mapped only in complex with Lucien soils.

Representative profile of a Dill fine sandy loam from an area of Lucien-Dill fine sandy loams, 3 to 12 percent slopes, in native range (100 feet south and 1,000 feet west of the northeast corner of sec. 25, T. 7 N., R. 12 W.):

A1—0 to 12 inches, reddish-brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak, very fine, granular structure; slightly hard, very friable; slightly acid; gradual, smooth boundary.

B—12 to 30 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 5/4) moist; weak, coarse, prismatic structure that parts to weak, medium, subangular blocky; slightly hard, very friable; slightly acid; clear, smooth boundary.

R—30 inches +, red (2.5YR 5/6) sandstone, red (2.5YR 4/6) moist; weakly cemented; easy to penetrate with hand auger when moist but difficult to penetrate when dry; slightly acid.

The texture of the A horizon generally is fine sandy loam, but it is loamy fine sand in small areas. Its color is reddish brown in hue of 2.5YR or 5YR. Reaction is slightly acid or neutral. The B horizon is fine sandy loam, very fine sandy loam, or loamy fine sand. It is reddish brown or red in hue of 2.5YR, 5YR, or 10R. Reaction ranges from slightly acid through mildly alkaline. Depth to sandstone ranges from 20 to 48 inches.

Dill soils are shallower to sandstone than Noble soils. They have a sandier B horizon than Cobb and Shellabarger soils.

Dougherty Series

The Dougherty series consists of deep, very gently sloping to sloping soils on uplands. These soils formed in reddish, sandy or loamy sediment under oak forest and mid and tall grasses.

In a representative profile (fig. 2) the surface layer is grayish-brown loamy fine sand about 7 inches thick and very pale brown loamy fine sand to a depth of 27 inches. Between a depth of 27 and 39 inches is yellowish-red sandy clay loam. The next layer is yellowish-red fine sandy loam to a depth of about 61 inches. It is underlain by red loamy fine sand.

Dougherty soils are well drained and are moderately permeable. The intake rate is high.

Representative profile of Dougherty loamy fine sand from an area of Dougherty and Eufaula loamy fine sands, 3 to 8 percent slopes, in a pasture of tame grass (1,000 feet west and 100 feet south of the northeast corner of sec. 27, T. 9 N., R. 11 W.):

A1—0 to 7 inches, grayish-brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak, very fine, granular structure; soft, very friable; slightly acid; clear, smooth boundary.

A2—7 to 27 inches, very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) moist; single grain; soft, very friable; slightly acid; clear, smooth boundary.

B2t—27 to 39 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; very hard, friable, sticky; common roots; common pores; clay films on ped faces; strongly acid; gradual, smooth boundary.

Figure 2.—**Representative profile of a Dougherty loamy fine sand.**

B3—39 to 61 inches, yellowish-red (5YR 5/6) fine sandy loam' yellowish red (5YR 4/6) moist; weak, medium, prismatic structure; hard, friable; sand grains coated; medium acid; diffuse, smooth boundary.

C—61 to 72 inches, red (2.5YR 5/8) loamy fine sand, red (2.5YR 4/8) moist; single grain; slightly hard, very friable; sand grains coated; slightly acid.

The A1 horizon ranges from pale brown to dark grayish brown in hue of 10YR. It ranges from medium acid to slightly acid in reaction. The A2 horizon is very pale brown to pale brown and light yellowish brown in hue of 10YR. Reaction ranges from medium acid to slightly acid. The B horizon ranges from red to reddish brown to reddish yellow and yellowish red in hues of 2.5YR to 7.5YR. Reaction ranges from medium acid to strongly acid. Texture of the B horizon is fine sandy loam or sandy clay loam. The C horizon ranges from sandy clay loam to loamy fine sand. Colors in this horizon range from red to yellowish red and strong brown in hues of 2.5YR and 7.5YR.

Dougherty soils have a thicker A horizon than that in Konawa soils. They are finer textured between a depth of 20 and 40 inches than Eufaula soils.

Dougherty loamy fine sand, 1 to 3 percent slopes (DoB).—This very gently sloping soil is on the sides and tops of broad hills. The areas were orginally under oak forest.

Included with this soil in mapping, and making up about 30 percent of the mapped areas, is Konawa loamy fine sand that has an A horizon 12 to 20 inches thick. Also included are small areas of Eufaula loamy fine sand and of soils that are similar to Dougherty soils except that they have sandstone at a depth of less than 48 inches.

This Dougherty soil is used mainly for peanuts, cotton, alfalfa, grain sorghum, and small grains, but some areas are used for tame pasture or native range. Where water is available this soil is suitable for sprinkler irrigation. In a small acreage the original stand of trees remains. Capability unit IIIe-4, dryland, and IIIe-2, irrigated; Deep Sand Savannah range site; woodland suitability group 1.

Dougherty and Eufaula loamy fine sands, 3 to 8 percent slopes (DuD).—This undifferentiated unit is made up of Dougherty and Eufaula loamy fine sands on uplands. The native vegetation is trees and mid and tall grasses.

Most mapped areas of this unit contain both the Dougherty and the Eufaula soils, but some of the mapped areas consist of only one of these soils. The Dougherty soil has the profile described as representative of its series and makes up about 50 percent of the mapped areas. The Eufaula soil has a loamy fine sand surface layer more than 40 inches thick underlain by thin layers of fine sandy loam, but its profile otherwise is similar to that described as representative of the Eufaula series. It makes up about 30 percent of the unit.

Included with these soils in mapping, and making up about 10 percent of the unit, are small areas of Konawa loamy fine sand. Also included, and making up about 10 percent of the unit, are small areas of Eufaula fine sand, of Darnell fine sandy loam, and of a soil similar to the Dougherty but that has sandstone at a depth of less than 48 inches.

Most of the acreage of this unit is used for peanuts, grain sorghum, cotton, and small grains. Some areas are used for tame pasture, and sizable areas are used for native range. Capability unit IVe-5, dryland, and IVe-2, irrigated; Deep Sand Savannah range site; woodland suitability group 2.

Eufaula Series

Eufaula soils are deep. They have very gently sloping to rolling and complex slopes. These soils formed under mid and tall grasses and oak forest in sandy material laid down by water and wind.

In a representative profile the surface layer is pale-brown, slightly acid fine sand about 8 inches thick. The next layer is pink, slightly acid fine sand about 32 inches thick. Between a depth of 40 and 72 inches is medium acid, yellowish-red fine sand and strata of loamy fine sand.

Eufaula soils are somewhat excessively drained and are rapidly permeable. Available water capacity is low, and intake rate is high.

Representative profile of Eufaula fine sand, rolling, in a forest (2,110 feet south and 50 feet west of the northeast corner of sec. 21, T. 6 N., R. 9 W.):

A1—0 to 8 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 4/3) moist; single grain; loose when moist and when dry; slightly acid; gradual, smooth boundary.

A21—8 to 40 inches, pink (7.5YR 7/4) fine sand, light brown (7.5YR 6/4) moist; single grain; loose when moist and when dry; slightly acid; clear, wavy boundary.

A22&B2t—40 to 72 inches, yellowish-red (5YR 5/6) fine sand, yellowish red (5YR 4/6) moist; structureless; contains bands of reddish-brown (5YR 5/4) loamy fine sand 3/8 to 1 inch thick and 2 to 4 inches apart that have weak

medium, subangular blocky structure, loose matrix slightly hard in the bands; sand grains coated in matrix; clay bridges the sand grains in the bands; medium acid.

The A1 horizon ranges from fine sand to loamy fine sand. Its color ranges from brown to light brownish gray in hues of 7.5YR and 10YR. Reaction in this horizon is medium acid or slightly acid. The A2 horizon is loamy fine sand or fine sand. It ranges from pink to light yellowish brown in hues of 7.5YR and 10YR. Reaction is medium acid to neutral. The A22 and B2t horizon is dominantly loamy fine sand or fine sand, and the bands in this horizon range from ⅛ to 1 inch in thickness. It is light reddish brown to yellowish red in hues of 2.5YR through 7.5YR. Reaction in this horizon ranges from slightly acid to strongly acid.

Eufaula soils have a thicker A2 horizon than Dougherty and Konawa soils.

Eufaula fine sand, rolling (EfD).—This soil has the profile described as representative of the Eufaula series. It formed in thick sandy deposits. Slopes are mostly between 5 and 15 percent.

Included with this soil in mapping are a few areas of Dougherty loamy fine sand. Also included are small areas of Eufaula loamy fine sand and of Darnell and Noble fine sandy loams. In the northwestern part of the county are a few areas that are loamy fine sand throughout.

This Eufaula soil is not suitable for cultivation. Nearly all of the acreage is used for native range but some areas are used for tame pasture. Capability unit VIs–1; Deep Sand Savannah range site; woodland suitability group 3.

Eufaula loamy fine sand, 1 to 3 percent slopes (EuB).—This very gently sloping soil is on foot slopes of uplands. It formed in sandy deposits.

This soil is loamy fine sand to a depth of about 40 inches. Below that depth the dominant texture is loamy fine sand that contains thin layers of fine sandy loam.

Included with this soil in mapping are a few small areas of Dougherty loamy fine sand. Also included are small areas of Eufaula fine sand and of Noble fine sandy loam.

This Eufaula soil is used mainly for peanuts, small grains, cotton, grain sorghum, and tame pasture. Some areas, however, are used for native range. Capability unit IVs–2, dryland, and IVs–2, irrigated; Deep Sand Savannah range site; woodland suitability group 2.

Eufaula loamy fine sand, hummocky (EuC).—This soil is on hummocky uplands. Slopes are dominantly between 3 and 8 percent. The profile is loamy fine sand throughout, and the material below the surface layer is slightly redder than that in the profile described as representative of the Eufaula series.

Included with this soil are some small areas of Minco very fine sandy loam. Also included are small areas of Noble fine sandy loam, and a few areas of sandstone outcrops.

Most of the acreage of this Eufaula soil is cultivated, and cotton, peanuts, grain sorghum, and small grains are the main crops. Some of the steeper slopes have been seeded to native grass. Other areas remain in native grass, and still others are used for tame pasture. Capability unit IVe–5, dryland, and IVs–2, irrigated; Deep Sand Savannah range site; woodland suitability group 3.

Foard Series

The Foard series consists of deep, nearly level soils on uplands. These soils formed under mid grasses in calcareous clayey and loamy sediment.

In a representative profile the surface layer is dark grayish-brown silt loam about 8 inches thick. This layer is abruptly underlain to a depth of 28 inches by dark grayish-brown clay that is high in sodium. Between a depth of 28 and 52 inches, the layer is brown calcareous clay that is high in sodium and contains many calcium carbonate concretions. This layer is underlain by reddish-brown or red, moderately alkaline silty clay loam that contains a few calcium carbonate concretions.

These soils are moderately well drained and are very slowly permeable. Available water capacity is high, and intake rate is low. Deep cracks form in this soil during dry periods.

Representative profile of Foard silt loam, 0 to 1 percent slopes, in a cultivated field (200 feet east and 100 feet south of the northwest corner of the northeast quarter of sec. 9, T. 6 N., R. 13 W.):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; slightly hard, friable; slightly acid; abrupt, smooth boundary.

B2t—8 to 28 inches, dark grayish-brown (10YR 4/2) clay, very dark brown (10YR 2/2) moist; moderate, coarse, prismatic structure that parts to moderate, medium, blocky; extremely hard, very firm; common roots; thin continuous clay films; cracks filled with silty material from Ap horizon; neutral; gradual, wavy boundary.

B31ca—28 to 44 inches, brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; weak, coarse, blocky structure; extremely hard, very firm; a few slickensides; cracks filled with silty material from Ap horizon; many semihard calcium carbonate concretions; calcareous; gradual, wavy boundary.

B32ca—44 to 52 inches, brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; weak, coarse, blocky structure; extremely hard, very firm; a few slickensides of grayish brown in hue of 10YR; many, semihard concretions of calcium carbonate; calcareous; gradual, wavy boundary.

C1—52 to 66 inches, reddish-brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; 5 percent of mass is dark grayish-brown (10YR 4/2) mottles; massive; extremely hard, very firm; moderately alkaline; a few soft gypsum crystals and a few hard calcium carbonate concretions; gradual, smooth boundary.

C2—66 to 72 inches, red (2.5YR 5/6) silty clay loam, red (2.5 YR 4/6) moist; massive, traces of intermixed grayish-brown earth; extremely hard, very firm; matrix is noncalcareous; moderately alkaline; 2 to 3 percent is semihard concretions of calcium carbonate.

The A horizon is mostly silt loam, but it ranges to silty clay loam. Its color ranges from grayish brown to dark brown in hues of 10YR and 7.5YR. Reaction is slightly acid or neutral. The B2t horizon is silty clay loam, silty clay, or clay. It ranges from grayish brown to dark brown. Reaction is neutral to moderately alkaline. The B3 horizon ranges from dark grayish brown to yellowish red in hues of 5YR through 10YR. Its texture is silty clay loam, silty clay, or clay. Reaction is mildly alkaline or moderately alkaline and calcareous. The exchangeable sodium content of the Bt horizon ranges from 15 to 25 percent. The C horizon ranges from reddish to brownish in hues of 2.5YR to 10YR. The redder hues are associated with the Permian material. Reaction is mildly alkaline or moderately alkaline.

Foard soils lack the silty clay loam B1 horizon of Hollister soils. Unlike Tillman soils, they have a Bt horizon that is high in sodium. Foard soils are deeper to bedrock than Vernon soils.

Foard silt loam, 0 to 1 percent slopes (FoA).—This is the only Foard soil mapped in the county.

Included with this soil in mapping, and making up from 5 to 10 percent of each mapped area, are small areas of Hollister silt loam, 0 to 1 percent slopes. Also included,

and making up about 10 percent of the mapped areas, are small areas of a soil similar to this Foard soil but that has a surface layer 10 to 12 inches thick. Other included small areas consist of a Tillman silty clay loam that makes up about 5 percent of each mapped area.

Most areas of Foard silt loam, 0 to 1 percent slopes, are cultivated, and small grains, grain sorghum, cotton, and alfalfa are the main crops. Some areas are in native range. Capability unit IIs–1, dryland, and IIs–1, irrigated; Hardland range site; woodland suitability group 3.

Gracemont Series

The Gracemont series consists of deep, nearly level soils on flood plains. These soils formed in alluvium under a cover of tall grasses. They have a water table at a depth of less than 40 inches.

In a representative profile the surface layer is reddish-brown fine sandy loam about 14 inches thick. The next layer, between a depth of 14 and 34 inches, is red fine sandy loam that contains thin strata of darker colored loam. Between a depth of 34 and 46 inches is reddish-brown fine sandy loam stratified with browner material. Below is dark grayish-brown loam.

These soils are somewhat poorly drained. Permeability is moderately rapid. Available water capacity is high, and intake rate is moderate. These soils are subject to flooding.

Representative profile of Gracemont fine sandy loam from an area of Gracemont soils, in a tame grass pasture (855 feet north and 90 feet east of the southwest corner of the southeast quarter of sec. 33, T. 9 N., R. 10 W.):

A1—0 to 14 inches, reddish-brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak, fine, granular structure; slightly hard, very friable; calcareous; moderately alkaline; clear, smooth boundary.

C1—14 to 34 inches, red (2.5YR 4/6) fine sandy loam, dark red (2.5YR 3/6) moist; massive; slightly hard, friable; strata of darker loam as much as 3 inches thick that are separated from the mass by evident bedding planes; a few soft spots of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

C2—34 to 46 inches, reddish-brown (5YR 5/4) fine sandy loam; dark reddish brown (5YR 3/4) moist; massive; slightly hard, very friable; stratified browner material; common soft spots of calcium carbonate; free water; calcareous; mildly alkaline; clear, smooth boundary.

Ab—46 to 54 inches, dark grayish-brown (10YR 4/2) loam; very dark brown (10YR 2/2) moist; massive; slightly hard, friable; common soft spots of calcium carbonate; free water; calcareous; mildly alkaline.

The A horizon is loamy fine sand to clay loam. It ranges from reddish brown and dark reddish brown to dark brown in hues of 2.5YR to 10YR. The soil is calcareous at a depth between 10 and 20 inches, and in most areas it is calcareous at the surface. The C horizon is reddish brown and red to dark brown and yellowish brown in hues of 2.5YR through 10YR. It is fine sandy loam to loam to a depth of 40 inches, but below that depth the texture is finer and coarser. In places a buried horizon occurs at a depth below 20 inches. The buried horizon is calcareous and generally contains soft spots of calcium carbonate. The seasonal water table is at a depth of less than 40 inches most of the year.

Gracemont soils are similar to the Yahola soils in profile characteristics, but unlike those soils they have a seasonal water table. They have a more reddish C horizon than Cyril soils, and unlike Pulaski soils they have a calcareous surface layer. They are coarser textured than Port soils.

Gracemont soils (Gm).—This is the only mapping unit in the Gracemont series mapped in the county. It is made up of nearly level soils on flood plains. These soils are flooded more than once each year.

Included with these soils in mapping are small areas of Pulaski soils and of Yahola soils. Also included are a few small areas of soils that have slopes of up to 4 percent.

Most of the acreage of this unit is used for tame pasture, but some areas are used for native range. Capability unit Vw–2; Subirrigated range site; woodland suitability group 3.

Grant Series

The Grant series consists of deep, very gently sloping to sloping soils on uplands. These soils formed in loamy material from red beds under a cover of mid and tall grasses. Depth to sandstone or siltstone is more than 40 inches.

In a representative profile the surface layer is brown, mildly alkaline loam about 9 inches thick. The next layer, at a depth between 9 and 19 inches, is reddish-brown, mildly alkaline loam. Between a depth of 19 and 44 inches is yellowish-red, moderately alkaline silt loam that grades to loam. Yellowish-red, calcareous loam that contains a few soft limy spots and a few hard concretions of calcium carbonate is between a depth of 44 and 66 inches.

Grant soils are well drained and are moderately permeable. Available water capacity is high, and intake rate is moderate.

Representative profile of Grant loam, 3 to 5 percent slopes, in a native pasture (2,460 feet south and 100 feet east of the northwest corner of sec. 30, T. 9 N., R. 13 W.):

A—0 to 9 inches, brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure; slightly hard, friable; nonsticky; many roots; many pores; mildly alkaline; gradual, smooth boundary.

B1—9 to 19 inches, reddish-brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky; common roots and pores; mildly alkaline; gradual, smooth boundary.

B2t—19 to 36 inches, yellowish-red (5YR 5/6) silt loam, yellowish red (5YR 3/6) moist; moderate, medium, prismatic structure that parts to moderate, medium, granular; very hard, friable, sticky; common roots, a few patchy clay films on ped faces; moderately alkaline; noncalcareous; gradual, smooth boundary.

B31—36 to 44 inches, yellowish-red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; weak, fine, subangular blocky structure; hard, friable, nonsticky; patchy clay films on ped faces; moderately alkaline; noncalcareous; gradual, smooth boundary.

B32—44 to 66 inches, yellowish-red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; weak, fine, subangular blocky structure; hard, friable; patchy clay films on ped faces; calcareous; a few soft limy spots; a few hard concretions.

The A horizon is dominantly loam, but it ranges to silt loam. Its color ranges from reddish brown to dark brown in hues of 5YR and 7.5YR. Reaction in this horizon ranges from neutral to mildly alkaline. The B1 horizon ranges from loam to clay loam and from reddish brown to dark reddish brown in the 5YR hue. Reaction ranges from neutral to mildly alkaline. The B2t horizon ranges from silt loam to silty clay loam and from dark reddish brown to yellowish red in hues of 2.5YR and 5YR. It ranges from neutral to moderately alkaline in reaction and in places is calcareous in the lower part. The B3 horizon ranges from loam to silty clay loam and from dark reddish brown to yellowish red in hues of 2.5YR and 5YR. Reaction is neutral to moderately alkaline and calcareous.

Grant soils have a more silty B horizon than that in Cobb and Dill soils. They have a less clayey B horizon than that in Norge

soils. Grant soils differ from Pond Creek soils in having colors with moist chromas of 3.5 or more at a depth of less than 20 inches.

Grant loam, 1 to 3 percent slopes (GrB).—This very gently sloping soil occupies mostly convex areas on uplands. Included with this soil in mapping are a few small areas of Pond Creek fine sandy loam and of Norge silt loam.

Nearly all the acreage of this soil is cultivated, and wheat, peanuts, alfalfa, cotton, and grain sorghum are the main crops. Some areas, however, are used for tame pasture or native range. Capability unit IIe–1, dryland, and IIe–1, irrigated; Loamy Prairie range site; woodland suitability group 2.

Grant loam, 3 to 5 percent slopes (GrC).—This gently sloping soil has the profile described as representative of the Grant series. It is on the sides and tops of hills on uplands.

Included with this soil in mapping are a few areas of Cobb fine sandy loam and of Norge silt loam. Also included are small areas of Minco silt loam.

Nearly all the acreage of this soil is cultivated, and wheat, peanuts, alfalfa, cotton, and grain sorghum are the main crops. Some areas are used for tame pasture or native range. Capability unit IIIe–1, dryland, and IIIe–1, irrigated; Loamy Prairie range site; woodland suitability group 2.

Grant loam, 3 to 6 percent slopes, eroded (GrC2).—This sloping soil is on the sides of hills and in swales near the heads of drainageways where excess water accumulates. The areas are cut by many rills and small gullies that can be crossed with farm machinery. Part of the original surface layer has been removed through erosion, and the present surface layer is a mixture of the remaining surface layer and of material formerly in the subsoil. In several places the underlying material is exposed.

Included with this soil in mapping are a few, small areas of an eroded Cobb fine sandy loam, of Quinlan loam, and of Woodward loam.

Most of the acreage of this soil is cultivated, and small grains, cotton, peanuts, and grain sorghum are the main crops. Many areas have been seeded to native grasses, and some areas are used for tame pasture. Capability unit IVe–2, dryland, and IVe–1, irrigated; Loamy Prairie range site; woodland suitability group 3.

Grant loam, 5 to 8 percent slopes (GrD).—This sloping soil is on the tops and sides of hills on uplands. Included in mapping are a few, small areas of Cobb fine sandy loam, of Norge silt loam, of Quinlan loam, and of Woodward loam.

Most of the acreage of this soil is used as native range, but some areas are used for small grains, grain sorghum, and cotton. In places areas formerly cultivated have been seeded to native grass. Some areas are used for tame pasture. Capability unit IVe–1, dryland, and IVe–1, irrigated; Loamy Prairie range site; woodland suitability group 3.

Grant-Wing complex, 1 to 5 percent slopes (GwC).—This complex consists of very gently sloping to gently sloping soils on uplands. These soils generally are on long, smooth side slopes and the tops of hills, but in some places they are in drainageways.

The Grant part makes up about 30 percent of this complex; the Wing part, about 25 percent; and a soil that is transitional between Grant and Wing, about 20 percent. The remaining 25 percent is about 15 percent Pond Creek and Foard soils, and about 10 percent is a soil that is similar to the Wing soil but that has underlying layers of clay.

The Grant and Wing soils each have a profile similar to that described as representative of their respective series. The color, texture, and reaction of the transitional soil are similar to those in the Grant soil, but in places salt crystals have accumulated below the surface.

More than half of the acreage of this complex is cultivated, and small grains, alfalfa, cotton, and grain sorghum are the main crops. The rest of the acreage is used as range and as tame pasture. Both parts in capability unit IVs–1, dryland, and IVs–1, irrigated, and in woodland suitability group 3; Grant part in Loamy Prairie range site, and Wing part in Slickspot range site.

Gypsum Outcrop

In this county Gypsum outcrop is mapped only as part of Acme-Gypsum outcrop complex, 2 to 8 percent slopes (AgD). This land type consists of exposures of bare gypsum bedrock and loamy soil material up to 3 inches thick.

Hollister Series

The Hollister series consist of deep, nearly level soils on uplands. These soils formed under a cover of short and mid grasses in material weathered from calcareous, clayey material of Permian age.

In a representative profile the surface layer is a brown silt loam and silty clay loam about 14 inches thick. Between a depth of 14 and 48 inches is brown clay that is calcareous at a depth of 37 inches. The next layer, between a depth of 48 and 72 inches, is brown calcareous clay.

Hollister soils are subject to cracking in dry weather. The high shrink-swell properties of this soil help water to penetrate when the soil is dry, but the shrinking and swelling can damage plant roots. These soils are well drained and slowly permeable. Available water capacity is high, and intake rate is low.

Representative profile of Hollister silt loam, 0 to 1 percent slopes, in a cultivated field (1,600 feet west and 100 feet north of the northeast corner of sec. 23, T. 6 N., R. 13 W.):

Ap—0 to 11 inches, brown (10YR 4/3) silt loam, dark brown (10YR 3/3) moist; moderate, medium, granular structure; hard, friable; mildly alkaline; clear, smooth boundary.

B1—11 to 14 inches, brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) moist; moderate, medium, subangular blocky structure; very hard, firm, neutral; clear, smooth boundary.

B21t—14 to 30 inches, brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate, medium, prismatic structure that parts to moderate, medium, blocky; very hard, firm; patchy clay films; vertical cracks filled with silt loam that is darker colored than that in the rest of the horizon; mildly alkaline; gradual, wavy boundary.

B22t—30 to 37 inches, brown (7.5YR 5/3) clay, dark brown (7.5YR 3/3) moist; moderate, medium, blocky structure; very hard, firm; vertical cracks filled with darker colored material than that in the rest of the horizon; a few soft lime concretions; moderately alkaline; clear, wavy boundary.

B23tca—37 to 48 inches, brown (7.5YR 5/3) clay, dark brown (7.5YR 3/3) moist; moderate, fine, subangular blocky structure; very hard, firm; patchy clay films on ped faces; vertical cracks filled with darker material than that in the rest of the horizon; a few soft lime concretions; calcareous; gradual, wavy boundary.

B24tca—48 to 72 inches, brown (5YR 4/5) clay, dark reddish brown (5YR 3/4) moist; weak, fine, subangular blocky structure; very hard, firm; patchy clay films on ped faces; vertical cracks filled with darker material than that in the rest of the horizon; calcareous.

The A horizon ranges from brown to very dark grayish brown in hue of 10YR. Reaction is neutral to mildly alkaline. The B1 horizon is silty clay, silty clay loam, or clay. It ranges from brown to very dark brown, and it is neutral to mildly alkaline. The B2t horizon ranges from clay loam to clay. It has colors that range from reddish brown to very dark grayish brown in hues of 5YR through 10YR. Reaction is mildly alkaline or moderately alkaline, and the soil is calcareous at a depth below 30 inches.

Hollister soils have a silty clay loam B1 horizon that is lacking in the Foard soils. They are less red in the Bt horizon than Tillman soils and are deeper than Vernon soils.

Hollister silt loam, 0 to 1 percent slopes (HoA).—This is the only Hollister soil mapped in the county. Included in mapping are a few small areas of Foard silt loam and small areas of slick spots.

Nearly all of the acreage of this soil is cultivated, and grain sorghum, alfalfa, small grains, and cotton are the main crops. A few small areas are in native range. Capability unit IIc–1, dryland, and I–2, irrigated; Hardland range site; woodland suitability group 3.

Konawa Series

The Konawa series consists of deep, very gently sloping to sloping soils on uplands. These soils formed in sandy or loamy sediment under cover of tall and mid grasses and oak forest.

In a representative profile the surface layer is light reddish-brown, slightly acid loamy fine sand about 6 inches thick. It is a mixture of material from the upper and lower parts of the original surface layer. Between a depth of 6 and 38 inches is reddish-brown or red, medium acid sandy clay loam that has prismatic structure. Below is red, medium acid loamy fine sand that has weak subangular blocky structure.

Konawa soils are well drained and are moderately permeable. Available water capacity is high, and intake rate is moderate. These soils are subject to wind and water erosion, and in Caddo County they are eroded or severely eroded.

Representative profile of Konawa loamy fine sand, 1 to 5 percent slopes, eroded, in a cultivated field (800 feet north and 100 feet east of the southwest corner of the northwest quarter of sec. 32, T. 8 N., R. 11 W.):

Ap—0 to 6 inches, light reddish-brown (5YR 6/4) loamy fine sand, reddish brown (5YR 4/4) moist; massive; loose, very friable; slightly acid; clear, smooth boundary.

B21t—6 to 22 inches, reddish-brown (2.5YR 5/4) sandy clay loam, dark reddish brown (2.5YR 3/4) moist; moderate, medium, prismatic structure; hard, friable, sticky; clay films on ped faces; medium acid; gradual, smooth boundary.

B22t—22 to 38 inches, red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; weak, medium, prismatic structure; hard, friable; patchy clay films on ped faces; medium acid; gradual smooth boundary.

B3—38 to 60 inches, red (2.5YR 5/6) loamy fine sand, red (2.5YR 4/6) moist; weak, medium, subangular blocky structure; slightly hard, very friable; sand grains coated and bridged; medium acid.

The A horizon ranges from 4 to 20 incles in thickness. The A1 and A2 horizons, where present, are not distinguishable in most places because of mixing by erosion and by plowing. The A horizon ranges from fine sandy loam to loamy fine sand, and from light reddish brown to brown in hues of 5YR and 7.5YR. Where cultivated, the surface layer is somewhat redder than that in areas not cultivated because of erosion and the mixing of reddish material from the B2t horizon with the remaining A horizon. Reaction in the A horizon is slightly acid to strongly acid. The B2t horizon ranges from sandy clay loam to fine sandy loam. It ranges from reddish brown to yellowish red in hues of 2.5YR to 7.5YR. Reaction is medium acid or strongly acid. The B3 horizon ranges from fine sandy loam to loamy fine sand.

Konawa soils have a finer textured Bt horizon than Eufaula soils. They have a thinner A horizon than that in Dougherty soils.

Konawa loamy fine sand, 1 to 5 percent slopes, eroded (KoC2).—This very gently sloping to gently sloping soil has the profile described as representative of the series (fig. 3). It is moderately eroded, and the areas are cut by rills and by gullies that can be crossed with farm machinery. Small areas of sandy deposition and small wind-

Figure 3.—**Representative profile of Konawa loamy fine sand, 1 to 5 percent slopes, eroded.**

scoured areas also are characteristic of the mapped areas. In many places reddish-brown material from the underlying layers has been mixed with the remaining surface layer by plowing. In a few places the underlying layers have been exposed by erosion.

Included with this soil in mapping are several small areas of Dougherty and Eufaula loamy fine sands and a few small areas of Konawa soils, severely eroded. Also included are a few small areas of Eufaula fine sand.

This Konawa soil is used mainly for cotton, peanuts, small grains, and grain sorghum. Some of the more sloping areas have been seeded to native grasses, and some areas are used for tame pasture. Capability unit IVe–6, dryland, and IVe–1, irrigated; Deep Sand Savannah range site; woodland suitability group 3.

Konawa soils, 2 to 8 percent slopes, severely eroded (KsD3).—Much of the original surface layer of these very gently sloping to sloping soils has been eroded away. The present surface layer is dominantly sandy clay loam to fine sandy loam. Wind scouring or deposition, blown-out areas, and many rills and small gullies are characteristic of the mapped areas.

Included in mapping are a few small areas of Dougherty and Eufaula loamy fine sands and of Eufaula fine sand. Also included are a few small areas of outcrops of sandstone.

These soils are not suitable for cultivation. Because of past erosion, it is difficult to establish a stand of grass on the areas. Nearly all of the acreage has been seeded to native grasses, but some areas are used for tame pasture. Capability unit VIe–4, dryland; Deep Sand Savannah range site; woodland suitability group 4.

Limestone Cobbly Land

Limestone cobbly land (Lm) consists of limestone cobblestones and of soil material between the cobblestones. The areas are underlain by limestone, limestone conglomerate, or caliche. The surface layer is loam to clay loam and ranges from 3 to 20 inches in thickness. From 15 to 75 percent of each mapped area is limestone cobblestones, and from 25 to 85 percent is soil material. Slopes are 3 to 20 percent.

Included with this unit in mapping and making up about 10 percent of the mapped areas, in equal parts, are small areas of Vernon soils, and of outcrops of limestone.

The vegetation on this land type consists of short, mid, and tall native grasses. Capability unit VIIs–2, dryland; Limestone Ridges range site; woodland suitability group 4.

Lucien Series

The Lucien series consists of shallow soils underlain by sandstone. These soils are gently sloping to steep and are on uplands. They formed in reddish, noncalcareous, soft, fine-grained sandstone under tall, mid, and short grasses.

In a representative profile the surface layer is a reddish-brown fine sandy loam about 8 inches thick. Below this layer to a depth of 17 inches is reddish-brown fine sandy loam that contains some sandstone fragments in the lower part. Reddish-yellow, fine-grained sandstone is at a depth of 17 inches. The sandstone is hard to penetrate with a hand auger when dry, and it is not easily penetrated by roots and water.

Lucien soils are well drained. Permeability is moderately rapid. Available water capacity is low, and intake rate is moderate. These soils are susceptible to erosion if not carefully managed.

Representative profile of a Lucien fine sandy loam from an area of Lucien-Dill fine sandy loams, 3 to 12 percent slopes, in native range (100 feet north and 50 feet west of the southeast corner of sec. 35, T. 7 N., R. 12 W.):

A1—0 to 8 inches, reddish-brown (5YR 5/3) fine sandy loam, dark reddish brown (5YR 3/3) moist; weak, very fine, granular structure; soft, very friable; slightly acid; gradual, smooth boundary.

B—8 to 17 inches, reddish-brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak, very fine, granular structure; soft, very friable; 5 to 25 percent is sandstone fragments; medium acid; gradual, smooth boundary.

R—17 inches +, reddish-yellow (5YR 6/6), fine-grained sandstone, yellowish red (5YR 5/6) moist; easily penetrated with a hand auger when moist, very hard to penetrate when dry; medium acid.

The A horizon ranges from reddish gray to brown in hues of 5YR and 7.5YR. Reaction in this horizon ranges from medium acid to neutral. The B horizon ranges from fine sandy loam to heavy loamy fine sand. Its color ranges from reddish brown to yellowish red in hues of 2.5YR and 5YR. Reaction ranges from medium acid to neutral. Small sandstone fragments in this horizon range from many to none. The range in color and reaction in the R horizon is similar to the range in the B horizon. Depth to sandstone is 7 to 20 inches.

Lucien soils, unlike Darnell soils, have colors that have dry values of less than 5.5 where the A horizon is 7 inches or more thick. They lack the calcareous surface layer of the Quinlan soils and are more sandy throughout than the Vernon soils.

Lucien-Dill fine sandy loams, 3 to 12 percent slopes (LuD).—These soils are gently sloping to strongly sloping and are on long, narrow ridges. The Lucien soil is on convex areas on the sides and the tops of the ridges and makes up about 50 to 75 percent of this complex. The Dill soil occurs between areas of the Lucien soil, generally in concave areas on the sides of the ridges, and makes up from 20 to 35 percent of the complex. A few areas of Noble fine sandy loam and outcrops of sandstone make up the remaining 5 to 15 percent of the mapped areas. The Lucien and Dill soils in this complex each have a profile like that described as representative of their respective series.

The soils in this complex are not suitable for cultivation. Nearly all areas are used for native range. Both parts in capability unit VIe–5, dryland, and in woodland suitability group 3; Lucien part in Shallow Prairie range site, and Dill part in Sandy Prairie range site.

Lucien-Dill fine sandy loams, 12 to 30 percent slopes (LuE).—These soils are moderately steep to steep and are on long, narrow ridges. The Lucien soil is in convex areas on the sides of hills and the tops of the ridges and makes up 60 to 80 percent of each mapped area. The Dill soil is in concave areas on the sides of the ridges and make up 10 to 30 percent of the mapped areas. Small areas of Noble fine sandy loam and of outcrops of sandstone makes up the remaining 5 to 15 percent of the mapped areas.

The Lucien soil in this unit has a surface layer that is about 5 inches thick. Depth to sandstone is about 11 inches. The Dill soil is underlain by sandstone at a depth of about 28 inches.

The soils in this complex are too shallow or too hilly for tillage. They are suited to range. Both parts in capability unit VIIe–3, dryland, and in woodland suitability group

4; Lucien part in Shallow Prairie range site, and Dill part in Sandy Prairie range site.

McLain Series

The McLain series consists of deep, nearly level soils on terraces. These soils formed in calcareous sediment laid down by water. The original vegetation was chiefly tall and mid grasses, but some areas were under forest.

In a representative profile the surface layer is brown silty clay loam to a depth of about 7 inches. Just below is dark reddish-gray, neutral silty clay loam to a depth of about 14 inches. The next layer, between a depth of 14 and 28 inches, is reddish-brown clay that has blocky structure and is mildly alkaline in reaction. Between a depth of 28 and 36 inches is reddish-brown, mildly alkaline silty clay loam that has subangular blocky structure. Below is reddish-brown, calcareous silty clay loam to a depth of 60 inches.

McLain soils are well drained and have moderately slow permeability. Available water capacity is high, and intake rate is moderate.

Representative profile of McLain silty clay loam in a cultivated field (1,000 feet south and 100 feet east of the northwest corner of sec. 13, T. 7 N., R. 9 W.):

Ap—0 to 7 inches, brown (7.5YR 4/2) silty clay loam, very dark brown (7.5YR 2/2) moist; moderate, medium, granular structure; hard, friable; neutral; clear, smooth boundary.

A12—7 to 14 inches, dark reddish-gray (5YR 4/2) silty clay loam, dark reddish brown (5YR 2/2) moist; weak, fine, blocky structure; very hard, firm; neutral; gradual, smooth boundary.

B2t—14 to 28 inches, reddish-brown (2.5YR 4/3) clay, dark reddish brown (2.5YR 3/3) moist; weak, fine, blocky structure; very hard, very firm; nearly continuous clay films on ped faces; mildly alkaline; gradual, smooth boundary.

B3—28 to 36 inches, reddish-brown (2.5YR 5/4) silty clay loam, reddish brown (2.5YR 4/4) moist; weak, medium, subangular blocky structure; very hard, firm; patchy clay films on ped faces; mildly alkaline; gradual, smooth boundary.

C—36 to 60 inches, reddish-brown (2.5YR 5/4) silty clay loam, reddish brown (2.5YR 4/4) moist; massive; hard, friable; calcareous and contains soft limy spots and a few hard concretions.

The A horizon ranges from silt loam to silty clay loam. It ranges from reddish gray to dark brown in hues of 5YR and 7.5YR. Reaction ranges from neutral to mildly alkaline. The B horizon ranges from silty clay loam to clay. It ranges from reddish brown to dark reddish brown in hues of 2.5YR and 5YR. Reaction in this horizon ranges from neutral to mildly alkaline, and in places the lower part is calcareous. The C horizon ranges from silt loam to silty clay loam and from light reddish brown to yellowish red. Depth to calcareous material generally is more than 30 inches.

McLain soils have a more clayey B horizon than Port and Reinach soils. They have a less clayey B horizon than Miller soils.

McLain silty clay loam (Mc).—This is the only McLain soil mapped in the county. It is nearly level and is on terraces.

Included with this soil in mapping are a few areas of Port silt loam and of Reinach silt loam.

Nearly all of the acreage of this soil is cultivated, and small grains, alfalfa, cotton, and grain sorghum are the main crops. Some areas are used for tame pasture or native range. Capability unit I–1, dryland, and I–2, irrigated; Loamy Bottomland range site; woodland suitability group 1.

Miller Series

The Miller series consists of deep, nearly level soils on flood plains. These soils formed in calcareous clayey and loamy sediment. The original vegetation was mid and tall grasses and trees.

In a representative profile the surface layer is reddish-brown, mildly alkaline silty clay loam about 8 inches thick. The next layer, between a depth of 8 and 27 inches, is weak-red, calcareous clay that has blocky structure. The layer at a depth between 27 and 47 inches is reddish-brown, calcareous clay that has a few soft limy spots and vertical cracks filled with darker colored material. At a depth of about 47 inches is reddish-brown, calcareous clay that contains a few limy spots and a few horizontal strata of red clay about 4 inches thick. Cracks extend downward and are filled with lighter colored material.

Miller soils are moderately well drained and have very slow permeability. Available water capacity is high, and intake rate is low. These soils are subject to flooding.

Representative profile of Miller silty clay loam in a cultivated field (400 feet west and 100 feet south of the northeast corner of sec. 11, T. 7 N., R. 12 W.):

Ap—0 to 8 inches, reddish-brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 2/2) moist; moderate, medium, granular structure; hard, friable; mildly alkaline; clear, smooth boundary.

B—8 to 27 inches, weak-red (2.5YR 4/2) clay, dusky red (2.5 YR 3/2) moist; weak, medium, blocky structure; very hard, very firm; shiny pressure faces; calcareous; moderately alkaline; gradual, smooth boundary.

C1—27 to 47 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; massive; very hard, very firm; shiny pressure faces; vertical cracks filled with darker material; 1 to 3 percent soft limy spots; calcareous; moderately alkaline; gradual, smooth boundary.

C2—47 to 73 inches, reddish-brown (2.5YR 5/4) clay, dark reddish brown (2.5YR 3/4) moist; massive; very hard, very firm; 3 to 5 percent concretions of calcium carbonate; a few horizontal strata of red (2.5YR 5/6) clay 4 inches thick; vertical cracks filled with lighter colored material; calcareous; moderately alkaline.

The A horizon ranges from reddish gray to dark reddish brown in hue of 5YR. Reaction ranges from neutral in a few places to moderately alkaline and calcareous. A few areas have recent sandy overwash on them. The B horizon ranges from silty clay loam to clay in texture. Its color ranges from reddish gray to dark reddish brown in hues of 2.5YR and 5YR. The C horizon is dominantly clay in texture, but it contains strata of clay loam in some areas. Its color ranges from reddish brown to dark red in hue of 2.5YR.

Miller soils have a more clayey and more calcareous B horizon than McLain and Port soils. They are more clayey throughout than Yahola soils.

Miller silty clay loam (Me).—This is the only Miller soil mapped in the county. It is nearly level to slightly concave and is on flood plains. The areas are flooded once in 5 to 20 years. Some areas are in old river oxbows or in filled secondary channels on the flood plain.

Included with this soil in mapping are a few small areas of Port silt loam and of Yahola soils. Also included are small areas of sandy overwash and of soils that have a texture of clay loam and clay.

Most of the acreage of this soil is cultivated, and cotton, grain sorghum, alfalfa, and small grains are the main crops. Some areas are used for tame pasture or native range. Capability unit IIIw–1, dryland, and IIIw–1, irrigated; Heavy Bottomland range site; woodland suitability group 4.

Minco Series

The Minco series consists of deep, gently sloping to steep soils on uplands. These soils formed under tall and mid grasses in alkaline, calcareous, loamy sediment.

In a representative profile the surface layer is brown, slightly acid silt loam about 12 inches thick. The next layer, to a depth of 34 inches, is brown silt loam that is neutral in reaction. Below this, to a depth of 72 inches, is brown silt loam that is mildly alkaline.

Minco soils are well drained and are moderately permeable. Available water capacity is high, and intake rate is moderate.

Representative profile of Minco silt loam, 3 to 5 percent slopes, in a cultivated field (1,000 feet south and 50 feet west of the northeast corner of sec. 13, T. 12 N., R. 11 W.):

Ap—0 to 12 inches, brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; moderate, fine, granular structure; slightly hard, very friable; common roots; slightly acid; gradual, smooth boundary.

B—12 to 34 inches, brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; moderate, fine, granular structure; slightly hard, friable; common roots; neutral; gradual, smooth boundary.

C—34 to 72 inches, brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; massive; slightly hard, very friable; mildly alkaline; calcareous.

The A horizon is loam, silt loam, very fine sandy loam, or fine sandy loam. It ranges from dark brown to reddish brown in hues of 7.5YR. Reaction ranges from slightly acid to neutral. The B horizon is typically silt loam, but it ranges to very fine sandy loam. Its color ranges from brown and reddish brown to yellowish red in hues of 7.5YR and 5YR. Reaction in this horizon is slightly acid or neutral. The C horizon ranges from very fine sandy loam to silt loam. Colors are the same as in the B horizon. Reaction ranges from neutral to moderately alkaline, and the horizon is calcareous in a few areas at a depth below 36 inches. Depth to bedrock is more than 48 inches.

Minco soils have a thinner A horizon than that in Reinach soils and a less clayey B horizon than that in Pond Creek soils. They are more silty throughout than Noble soils. Minco soils are browner and their B horizon is less clayey than that in Cobb and Shellabarger soils.

Minco silt loam, 3 to 5 percent slopes (MsC).—This gently sloping soil occupies convex areas that generally are within a few miles from major streams. It has the profile described as representative of the Minco series (fig. 4).

Included with this soil in mapping are small areas, generally on hillsides, of soils like Minco but that have calcium carbonate concretions in the upper part of the profile. Also included are small areas of Minco very fine sandy loam.

Nearly all areas of this Minco soil are cultivated. Small grains, alfalfa, grain sorghum, cotton, and peanuts are the main crops. Small areas are used for tame pasture, and a few areas that are irregular in shape are in native grass. Capability unit IIIe-1, dryland, and IIIe-1, irrigated; Loamy Prairie range site; woodland suitability group 2.

Minco very fine sandy loam, 3 to 8 percent slopes (MoD).—This gently sloping or sloping soil is mainly on hillsides and along drainageways or small creeks. Except that the soil is very fine sandy loam throughout, the profile of this soil is similar to that described as representative of the Minco series.

Included with this soil in mapping are a few small areas underlain by sandstone at a depth of less than 48 inches.

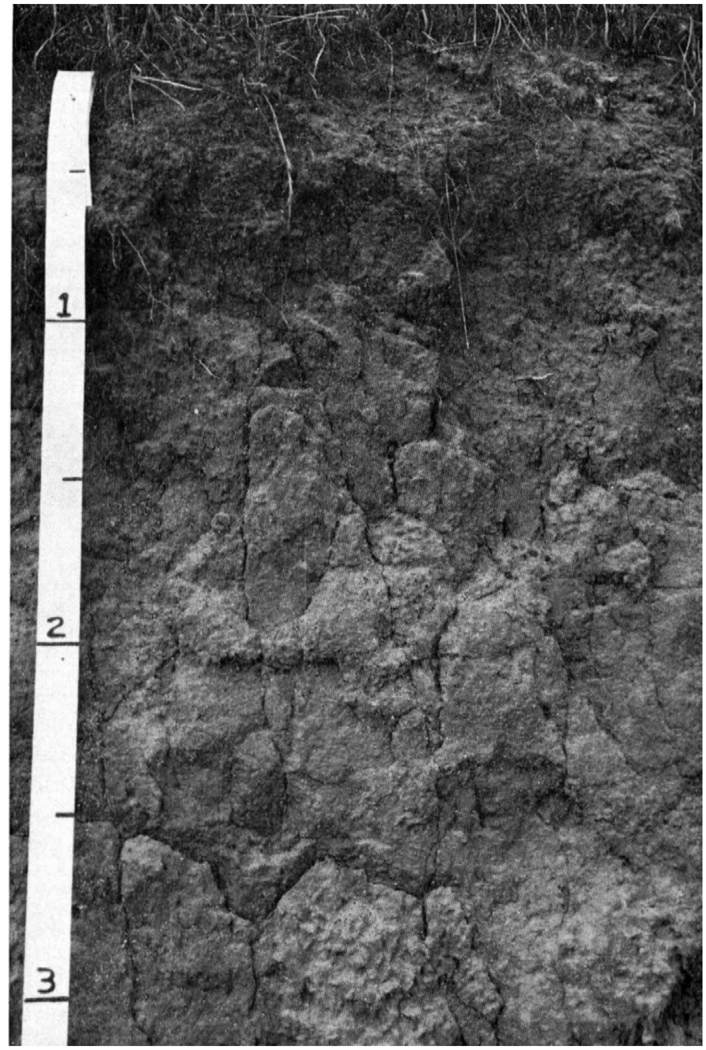

Figure 4.—**Profile of Minco silt loam, 3 to 5 percent slopes.**

Also included are a few eroded areas and small areas of outcrops of sandstone.

Most areas of this soil are cultivated. Small grains, peanuts, grain sorghum, and cotton are the main crops. Some areas are used for tame pasture. Some areas have never been cultivated, and these are used as native range. Capability unit IVe-1, dryland, and IVe-1, irrigated; Loamy Prairie range site; woodland suitability group 2.

Minco very fine sandy loam, steep (MoE).—This soil has moderately steep to steep, complex slopes and occupies upland areas that include drainageways. Slopes range from 12 to 30 percent. Except that this soil is very fine sandy loam throughout, the profile of this soil is similar to that described as representative of the Minco series.

Included with this soil in mapping, and making up 10 percent of the unit, are small areas of Dill fine sandy loam and of Lucien fine sandy loam. Also included are a few small areas of rock outcrops and of escarpments.

This Minco soil is not suitable for cultivation. It is best used for native range. Capability unit VIe-1, dryland; Loamy Prairie range site; woodland suitability group 3.

Noble Series

The Noble series consists of deep, very gently sloping to hilly soils on uplands. These soils formed under a cover of tall and mid grasses and oak forest.

In a representative profile the surface layer is a reddish-brown fine sandy loam about 9 inches thick. The next layer, at a depth between 9 and 28 inches, is reddish-brown fine sandy loam. Below this is fine sandy loam. Depth to sandstone is more than 48 inches.

These soils are well drained. Permeability is moderately rapid. Available water capacity is high, and intake rate is moderate.

Representative profile of Noble fine sandy loam, 3 to 8 percent slopes, in a cultivated field (500 feet east and 900 feet south of the northwest corner of sec. 4, T. 8 N., R. 9 W.):

Ap—0 to 9 inches, reddish-brown (5YR 5/3) fine sandy loam, dark reddish brown (5YR 3/3) moist; weak, fine, granular structure; slightly hard, very friable; many roots; many pores; slightly acid; gradual, smooth boundary.

B—9 to 28 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak, very fine, granular structure; slightly hard, very friable; common roots; many pores; slightly acid; gradual, smooth boundary.

C—28 to 72 inches, red (2.5YR 4/6) fine sandy loam, dark red (2.5 YR 3/6) moist; massive; slightly hard, very friable; many pores; slightly acid.

The A horizon generally is fine sandy loam, but in places it consists of winnowed layers of loamy fine sand less than 5 inches thick. Its color ranges from reddish brown to dark brown in hues of 5YR and 7.5YR. The B horizon ranges from reddish brown to dark reddish brown in hues of 2.5YR and 5YR. The C horizon ranges from loamy sand to fine sandy loam. Its color ranges from reddish brown to red and yellowish red in hues of 2.5YR and 5YR. Depth to sandstone is more than 48 inches. Reaction of all horizons is slightly acid or neutral.

Noble soils have a redder more sandy B horizon than Minco soils. They are deeper to sandstone than Dill soils.

Noble fine sandy loam, 1 to 3 percent slopes (NoB).—This very gently sloping soil occurs on foot slopes and in depressions. The areas are long and narrow and are parallel to drainageways or small creeks.

Included with this soil in mapping, and making up 20 to 25 percent of the acreage, are areas of a soil that is similar to this Noble soil but that has a slightly darker and slightly thicker surface layer. Also included are a few small areas of a soil that is similar to Noble but that has sandstone at a depth between 20 and 48 inches. Small areas of Dougherty loamy fine sand, of Eufaula loamy fine sand, and of sandstone outcrops are also included.

Most of the acreage of this soil is cultivated, and the major crops are small grains, grain sorghum, alfalfa, cotton, peanuts, and tame pasture plants. Some areas are used for native range. Capability unit IIe-2, dryland, and IIe-2, irrigated; Sandy Savannah range site; woodland suitability group 1.

Noble fine sandy loam, 3 to 8 percent slopes (NoD).—This gently sloping to sloping soil occurs on foot slopes and in depressions. It generally is in long, narrow areas that parallel drainageways or small creeks. It has the profile described as representative of the Noble series.

Included with this soil in mapping, and making up 20 to 25 percent of the acreage, are areas of a soil that is similar to this Noble soil but that has a slightly darker and slightly thicker surface layer. Also included are a few small areas of a soil that is similar to Noble but that has sandstone at a depth between 20 and 48 inches. Small areas of Dougherty and Eufaula loamy fine sands and of outcrops of sandstone are also included.

Most of the acreage of this Noble soil is cultivated. Small grains, grain sorghum, cotton, peanuts, and tame pasture plants are the main crops. Some areas are used for native range. Capability unit IVe-3, dryland, and IVe-2, irrigated; Sandy Savannah range site; woodland suitability group 2.

Norge Series

The Norge series consists of deep, very gently sloping to gently sloping soils on uplands. These soils formed under a cover of mid and tall grasses in material weathered from alkaline loamy red beds.

In a representative profile the surface layer consists of reddish-brown silt loam about 8 inches thick. The next layer, at a depth between 8 and 36 inches, is reddish-brown silty clay loam that has prismatic and subangular blocky structure. Below, from a depth of 36 to 46 inches, is neutral, red silty clay loam that has subangular blocky structure. These layers are underlain, at a depth between 46 and 74 inches, by red silty clay loam that has subangular blocky structure and contains a few soft spots and hard concretions of calcium carbonate.

Norge soils are well drained and have moderately slow permeability. Available water capacity is high, and intake rate is moderate.

Representative profile of Norge silt loam, 3 to 5 percent slopes, in a field that formerly was cultivated (1,200 feet west and 100 feet north of the southeast corner of sec. 8, T. 5 N., R. 10 W.):

Ap—0 to 8 inches, reddish-brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/3) moist; moderate, fine, granular structure; hard, friable, slightly sticky; medium acid; clear, smooth boundary.

B1—8 to 12 inches, reddish-brown (5YR 4/3) silty clay loam, dark, reddish brown (5YR 3/3) moist; moderate, medium, prismatic structure that parts to moderate, fine and medium, granular; hard, friable, slightly sticky; neutral; gradual, smooth boundary.

B21t—12 to 36 inches, reddish-brown (2.5YR 4/4) silty clay loam, dark reddish brown (2.5YR 3/4) moist; moderate, medium, prismatic structure that parts to moderate, medium, subangular blocky; hard, firm, sticky; many roots; many insect casts; nearly continuous clay films on ped faces; neutral; gradual, smooth boundary.

B22t—36 to 46 inches, red (2.5YR 4/6) silty clay loam, dark red (2.5YR 3/6) moist; moderate, medium, subangular blocky structure; hard, friable; a few patchy clay films on ped faces; neutral; gradual, smooth boundary.

B3—46 to 74 inches, red (2.5YR 5/6) silty clay loam, red (2.5YR 4/6) moist; weak, medium, subangular blocky structure; hard, friable; a few patchy clay films on ped faces; a few spots and concretions of calcium carbonate.

The A horizon is mainly silt loam, but it ranges to loam. Its color ranges from reddish gray to dark brown in hues of 5YR and 7.5YR. The B1 horizon ranges from silt loam to silty clay loam in texture and from reddish gray to reddish brown in hue of 5YR. Reaction ranges from slightly acid to neutral. The B2t horizon ranges from weak red to dark reddish brown in hues of 2.5YR and 5YR. It is silt loam to silty clay loam. Reaction ranges from neutral to slightly acid. The B3 horizon ranges from reddish brown to yellowish red in hues of 2.5YR and 5YR. Its texture is silt loam to silty clay loam. Reaction ranges from neutral to slightly acid. Depth to weathered red-bed material is 60 to 80 inches.

Norge soils have a more reddish B horizon than Pond Creek soils. They have a more clayey B horizon than Grant soils, and they are more silty throughout than Cobb, Shellabarger, and Dill soils.

Norge silt loam, 1 to 3 percent slopes (NrB).—This very gently sloping soil occupies convex slopes on uplands. Included in mapping are a few areas of Pond Creek silt loam and of Grant loam.

Most of the acreage of this soil is cultivated. The main crops are small grains, peanuts, alfalfa, cotton, grain sorghum, and tame pasture plants. Some areas are used for native range. Capability unit IIe–1, dryland, and IIe–1, irrigated; Loamy Prairie range site; woodland suitability group 2.

Norge silt loam, 3 to 5 percent slopes (NrC).—This gently sloping soil occupies convex slopes on uplands. It has the profile described as representative of the Norge series.

Included with this soil in mapping are a few small areas of Grant loam. Also included are a few areas that have sandstone or siltstone at a depth of less than 60 inches and a few areas of slick spots.

This soil is used mainly for cultivated crops. The chief crops are small grains, alfalfa, peanuts, grain sorghum, and cotton. Many areas are in tame pasture, and a small acreage remains in native range. Capability unit IIIe–1, dryland, and IIIe–1, irrigated; Loamy Prairie range site; woodland suitability group 2.

Pond Creek Series

The Pond Creek series consists of deep, nearly level or very gently sloping soils on uplands. These soils formed under a cover of mid and tall grasses in alkaline loamy deposits.

In a representative profile the surface layer is dark grayish-brown silt loam about 13 inches thick. Next, to a depth of 20 inches, is dark-brown silt loam, and then to a depth between 20 and 50 inches, dark-brown to brown silty clay loam. At a depth between 50 and 60 inches is loam that has subangular blocky structure and ped faces coated with clay. Below is reddish-brown, massive loam.

Pond Creek soils are well drained and have moderately slow permeability. Available water capacity is high, and intake rate is moderate.

Representative profile of Pond Creek silt loam, 0 to 1 percent slopes, in a cultivated field (1,580 feet north and 100 feet east of the southwest corner of sec. 22, T. 12 N., R. 12 W.):

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; hard, friable; medium acid; clear, smooth boundary.

A12—9 to 13 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, medium, granular structure; hard, friable; medium acid; gradual, smooth boundary.

B1—13 to 20 inches, dark-brown (10YR 4/3) silt loam, dark brown (10YR 3/3) moist; moderate, medium, granular structure; hard, friable; slightly acid; gradual, smooth boundary.

B21t—20 to 31 inches, dark-brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; moderate, medium, prismatic structure that parts to moderate, medium, granular; very hard, friable; patchy clay films on ped faces; neutral; gradual, smooth boundary.

B22t—31 to 41 inches, dark-brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; moderate, medium, prismatic structure that parts to moderate, medium, subangular blocky; very hard, friable; continuous clay films on ped faces; neutral; gradual, smooth boundary.

B23t—41 to 50 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak, medium, prismatic structure that parts to weak subangular blocky; very hard, friable; thin, patchy clay films on ped faces; neutral; gradual, smooth boundary.

B3—50 to 60 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) moist; weak, medium, subangular blocky structure; very hard, friable; a few patchy clay films on ped faces; some material from the C horizon mixed with this horizon; neutral; gradual, wavy boundary.

C—60 to 66 inches, reddish-brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; massive; hard, friable; sand grains coated; neutral.

The A horizon in mapping units PkA, PkB, and PkB2 is silt loam and loam. Its color ranges from brown to very dark grayish brown in hues of 7.5YR and 10YR. Reaction ranges from medium acid to neutral. The B1 horizon is similar to the A horizon in color. It is silt loam or silty clay loam. The B2t horizon is similar to the B1 horizon in texture, but its color ranges from dark yellowish brown in hues of 7.5YR and 10YR. Reaction of the B1 and B2t horizons is slightly acid or neutral. The B3 horizon is silt loam, loam, or silty clay loam. Its color ranges from reddish brown to dark brown in hues of 5YR and 10YR. Reaction is slightly acid or neutral. The C horizon is loam or silt loam in texture, and it ranges from red to yellowish red and strong brown in hues of 2.5YR to 7.5YR. Reaction is neutral to moderately alkaline.

Mapping units PcA and PcB are outside the defined range for the Pond Creek series. They are sandier throughout the solum, but they are enough like the Pond Creek series in morphology, composition, and behavior so that a new series is not warranted. The A horizon of these Pond Creek soils is fine sandy loam and loam. The B1 horizon is loam to clay loam, and its reaction ranges from medium acid to neutral. The B2t horizon is loam to clay loam. The C horizon is fine sandy loam or loam, and its reaction is slightly acid or neutral.

Pond Creek soils differ from the Grant soils in having colors with moist chromas of less than 3.5 extending to a depth of more than 20 inches. Their B horizon is browner and more silty than that in the Cobb soils, and it is not so red as that in the Norge soils.

Pond Creek silt loam, 0 to 1 percent slopes (PkA).—This nearly level soil occupies slightly convex slopes on uplands. It has the profile described as representative of the Pond Creek series.

Included with this soil in mapping are a few small areas of Pond Creek fine sandy loam and of Reinach silt loam.

Most of the acreage of this Pond Creek soil is used for small grains, cotton, peanuts, grain sorghum, and alfalfa. Some areas are used for tame pasture or native range. Capability unit I–2, dryland, and I–1, irrigated; Loamy Prairie range site; woodland suitability group 2.

Pond Creek silt loam, 1 to 3 percent slopes (PkB).—This very gently sloping soil occupies convex slopes on uplands.

Included with this soil in mapping are a few small areas of Pond Creek fine sandy loam. Also included are small areas of Reinach silt loam and of Cobb fine sandy loam.

Most of the acreage of this Pond Creek soil is cultivated. The main crops are small grains, peanuts, grain sorghum, cotton, and alfalfa. Some areas are used for tame pasture or native range. Capability unit IIe–1, dryland, and IIe–1, irrigated; Loamy Prairie range site; woodland suitability group 2.

Pond Creek silt loam, 1 to 3 percent slopes, eroded (PkB2).—This very gently sloping soil occurs on uplands

near the edge of less sloping soils and at the upper ends of drainageways where the slopes are stronger. The areas are small and are irregular in shape. Part of the original surface layer has been removed by erosion, and the present surface layer is a mixture of the remaining surface layer and of material formerly in the underlying layers. Rills and shallow gullies are common.

Included with this soil in mapping are a few small areas of Cobb fine sandy loam and Grant loam. Also included are small areas of sandstone outcrops.

Most of the acreage of this Pond Creek soil is cultivated. The main crops are alfalfa, cotton, small grains, grain sorghum, and peanuts. A few areas near the edges of fields have been seeded to native grass. Some areas are used for tame pasture. Capability unit IIIe–3, dryland, and IIIe–1, irrigated; Loamy Prairie range site; woodland suitability group 2.

Pond Creek fine sandy loam, 0 to 1 percent slopes (PcA).—This nearly level soil occurs on uplands. It is less silty in the surface layer and subsoil, but its profile otherwise is similar to that described as representative of the Pond Creek series (fig. 5).

Included with this soil in mapping are a few small areas of Cobb fine sandy loam and of Pond Creek silt loam. Also included are a few small areas of a soil that is similar to this Pond Creek fine sandy loam but that has a clayey, grayish-brown layer below the surface layer.

Most of the acreage of this Pond Creek soil is cultivated. The main crops are peanuts, cotton, grain sorghum, and alfalfa. Some areas are used for tame pasture or native range, and some areas are irrigated. Capability unit I–3, dryland, and I–1 irrigated; Sandy Prairie range site; woodland suitability group 1.

Pond Creek fine sandy loam, 1 to 3 percent slopes (PcB).—This very gently sloping soil occupies convex slopes on uplands. The surface layer is fine sandy loam, and the underlying layers are loam or clay loam, but the profile otherwise is similar to that described as representative of the series.

Included with this soil in mapping are a few small areas of Cobb fine sandy loam and of Pond Creek silt loam. Also included are a few small areas of a soil that is similar to this Pond Creek fine sandy loam but that has clayey, grayish-brown underlying layers.

Nearly all areas of this Pond Creek soil are cultivated. Small grains, alfalfa, grain sorghum, cotton, and peanuts are the main crops. Some areas are used for tame pasture or native range, and some areas are irrigated. Capability unit IIe–2, dryland, and IIe–1, irrigated; Sandy Prairie range site; woodland suitability group 1.

Port Series

The Port series consists of deep, nearly level soils on flood plains. These soils formed in mildly alkaline, calcareous, loamy sediment laid down by floodwater. They are subject to flooding. The native vegetation was mainly tall and mid grasses, but trees grew in a few places.

In a representative profile the surface layer is reddish-brown silt loam that is mildly alkaline and about 12 inches thick. Next, to a depth of 22 inches, is reddish-brown stratified silt loam, and then at a depth between 22 and 57 inches is dark reddish-gray and brown, calcareous silt loam. Below this is reddish-brown, calcareous loam that

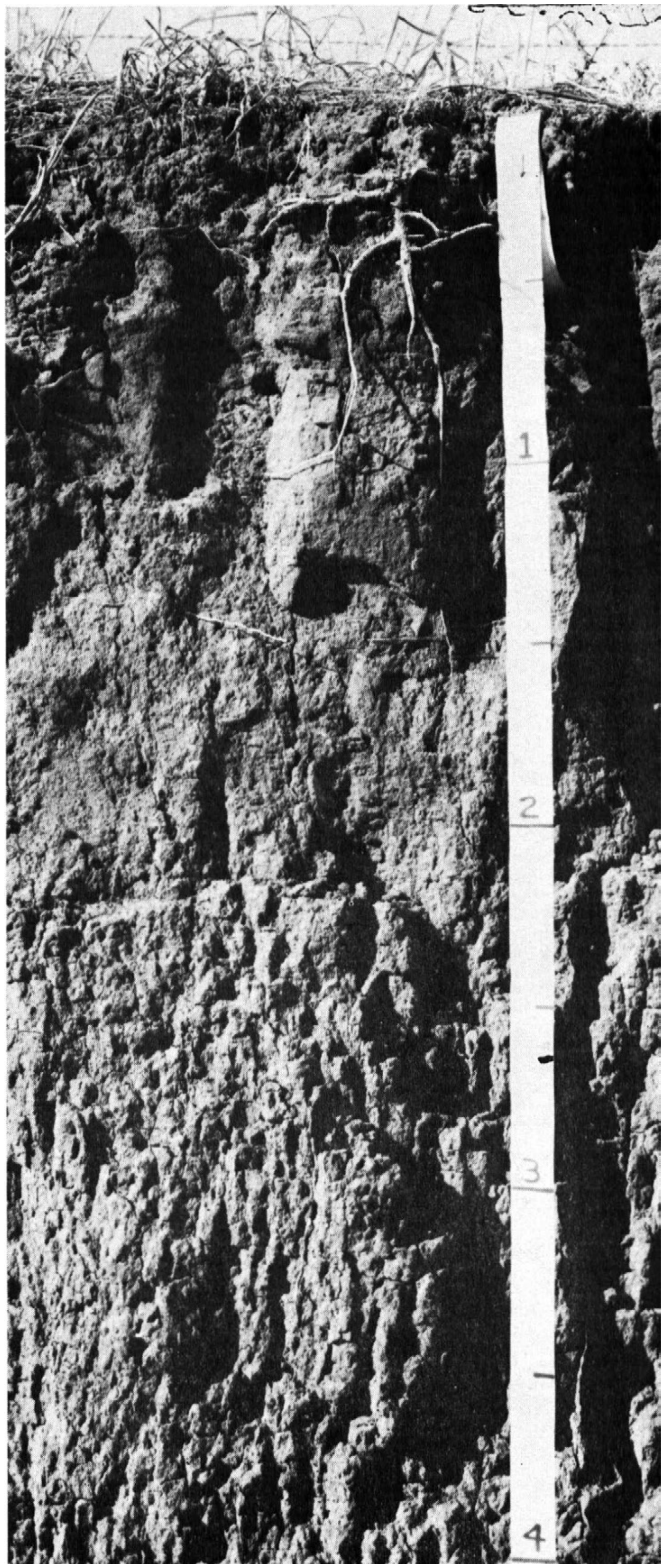

Figure 5.—Profile of Pond Creek fine sandy loam, 0 to 1 percent slopes.

at a depth of 67 inches grades to calcareous, light reddish-brown fine sandy loam.

Port soils are well drained and are moderately permeable. Available water capacity is high, and intake rate is moderate.

Representative profile of Port silt loam in a cultivated field (800 feet south and 50 feet west of the northeast corner of sec. 27, T. 8 N., R. 12 W.):

Ap—0 to 12 inches, reddish-brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/3) moist; weak, medium, granular structure; very hard, friable; 0 to 6 inches is plow layer; mildly alkaline; gradual, smooth boundary.

B1—12 to 22 inches, reddish-brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/3) moist; weak, medium, subangular blocky structure; very hard, friable; a few strata of light reddish-brown loam, one-fourth of an inch thick; mildly alkaline; gradual, smooth boundary.

B2—22 to 34 inches, dark reddish-gray (5YR 4/2) silt loam, dark reddish brown (5YR 3/2) moist; moderate, fine, granular structure; hard, friable; calcareous; mildly alkaline; clear, smooth boundary.

B3—34 to 57 inches, brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure; hard, friable; calcareous; mildly alkaline; gradual, smooth boundary.

C1—57 to 67 inches, reddish-brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; moderate, medium, granular structure; hard, friable; calcareous; mildly alkaline; gradual, smooth boundary.

C2—67 to 75 inches, light reddish-brown (5YR 6/4) fine sandy loam, reddish brown (5YR 5/4) moist; massive; slightly hard, very friable; calcareous; mildly alkaline.

The A horizon is dominantly silt loam and ranges from fine sandy loam to loam. In many areas the texture of the A horizon varies because of stratification, overwashing, and sedimentation. It ranges from reddish brown to dark brown in hues of 5YR and 7.5YR. Reaction ranges from neutral to moderately alkaline and noncalcareous. The B horizon ranges from loam to silty clay loam and from reddish gray to dark reddish brown in hue of 5YR. Reaction ranges from mildly neutral to alkaline and calcareous. The C horizon ranges from fine sandy loam to silty clay loam and from reddish brown to reddish yellow in hues of 2.5YR and 5YR. In some areas all horizons are stratified. Buried horizons occur in some areas. Depth to calcareous material generally ranges between 20 and 40 inches.

Port soils are more stratified below the A horizon than Reinach soils. They have a less clayey B horizon than McLain soils. They have a less calcareous and more silty B horizon than Yahola soils.

Port silt loam (Po).—This nearly level soil is on flood plains and is flooded once in 1 to 5 years. It has the profile described as representative of the Port series.

Included with this soil in mapping, and making up to 5 to 10 percent of the unit, are several areas of Yahola soils and small areas of McLain silty clay loam and of Pulaski soils. Also included are small sandy areas of overwash and some areas that are calcareous at the surface.

Nearly all of the acreage of this soil is cultivated. Small grains, alfalfa, grain sorghum, peanuts, and cotton are the main crops grown. Some areas are used for tame pasture or native range. Capability unit IIw–2, dryland, and IIw–2, irrigated; Loamy Bottomland range site; woodland suitability group 1.

Port and Pulaski soils, channeled (Pp).—Port and Pulaski soils each make up about 30 to 40 percent of this unit. The remaining 30 percent consists of soils that are like the Port but that have a more calcareous surface layer. Most areas consist of Port and Pulaski soils mapped together, but some mapped areas are made up of only one of these soils. This unit is flooded more often than once every year. The areas are marked by scour channels and recent sediment.

Mapped areas of these soils are mostly long and narrow and are 130 to 300 feet wide. They are lower than the areas that surround them, and they are separated from them by sloping to vertical banks. The banks are 3 to 15 feet high and have slopes that range mainly from 8 to 30 percent. The areas between the breaks contain other breaks that lead to stream channels. Some of the areas consist of a series of short, narrow breaks that have a stairstep effect. Between the breaks are areas where slopes are 0 to 3 percent.

These soils are not suited to cultivation. They are used for tame pasture or native range or as wildlife areas. Capability unit Vw–1, dryland; Loamy Bottomland range site; woodland suitability group 1.

Pulaski Series

The Pulaski series consists of deep, nearly level soils on flood plains. These soils formed in loamy alluvium under a cover of mid and tall grasses and trees.

In a representative profile the surface layer is slightly acid to medium acid, reddish-brown fine sandy loam about 18 inches thick. At a depth between 18 and 72 inches is yellowish-red fine sandy loam that contains bedding planes.

These soils are subject to flooding. They are well drained. Permeability is moderately rapid. Available water capacity is high, and intake rate is moderate.

Representative profile of Pulaski fine sandy loam from an area of Pulaski soils, in a cultivated field (800 feet north and 100 feet west of the southeast corner of sec. 1, T. 7 N., R. 10 W.):

Ap—0 to 10 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak, very fine, granular structure; soft, very friable; slightly acid; clear, smooth boundary.

A12—10 to 18 inches, reddish-brown (5YR 5/3) fine sandy loam, dark reddish brown (5YR 3/3) moist; weak, very fine, granular structure; soft, very friable; medium acid; gradual, smooth boundary.

C1—18 to 36 inches, yellowish-red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; massive; soft, very friable; weak bedding planes; slightly acid; gradual, smooth boundary.

C2—36 to 72 inches, yellowish-red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; massive; soft, very friable; neutral.

The A horizon ranges from loamy fine sand to fine sandy loam. Its color ranges from light reddish brown to brown in hues of 5YR and 7.5YR. Reaction ranges from medium acid to neutral. The C horizon ranges from fine sandy loam to loam to a depth of 40 inches, but below that depth, it ranges from loamy sand to clay loam. It ranges from red to dark brown in color and from medium acid to neutral in reaction. Stratification is common below a depth of 40 inches. In a few areas below a depth of 40 inches, reaction is moderately alkaline and calcareous.

Pulaski soils are more acid than Yahola and Cyril soils, which are calcareous in the surface layer. They have a sandier B horizon than Port soils. They are similar to Noble soils, but they have a less distinct A horizon and have a C horizon that has bedding planes within a depth of 20 inches.

Pulaski soils (Pu).—This mapping unit consists of nearly level soils on flood plains of small creeks. The areas

are flooded once in 1 to 5 years. This is the only unit of the Pulaski soils mapped in the county.

Included with these soils in mapping are a few small areas of Noble fine sandy loam, of Port silt loam, of Reinach silt loam, and of Yahola soils. Also included are a few small areas of Pulaski soils that have a high water table.

Most of the acreage of Pulaski soils is used for cultivated crops and tame pasture. The main crops are alfalfa, cotton, small grains, grain sorghum, and peanuts. Some areas are used for native range. Capability unit IIw–1, dryland, and IIw–1, irrigated; Loamy Bottomland range site; woodland suitability group 1.

Quinlan Series

The Quinlan series consists of gently sloping to strongly sloping soils on uplands that are shallow to bedrock. These soils formed under a cover of mid and tall grasses in material weathered from calcareous sandstone or siltstone.

In a representative profile the surface layer is reddish-brown silt loam about 7 inches thick. At a depth between 7 and 14 inches is red, calcareous silt loam. Below, to a depth of 55 inches, is calcareous, red, intermixed strata of sandstone and siltstone that include thin layers of gray sandstone or siltstone at a depth below 24 inches.

Quinlan soils are well drained. Permeability is moderately rapid. Available water capacity is low, and intake rate is moderate.

Representative profile of Quinlan silt loam from an area of Quinlan-Woodward complex, 5 to 12 percent slopes, in a native pasture (100 feet south and 100 feet east of the northwest corner of the northeast quarter of sec. 30, T. 9 N., R. 10 W.):

A1—0 to 7 inches, reddish-brown (5YR 4/4) silt loam, dark reddish brown (5YR 3/4) moist; moderate, fine, granular structure; soft, friable, slightly sticky; many roots; many pores; common insect casts; calcareous; moderately alkaline; clear, smooth boundary.

B—7 to 14 inches, red (2.5YR 4/6) silt loam, dark red (2.5YR 3/6) moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky; many roots; many pores; common insect casts; calcareous; moderately alkaline; gradual, smooth boundary.

R—14 to 55 inches, red (2.5YR 5/6) sandstone, red (2.5YR 4/6) moist; hard, friable, slightly sticky; weakly cemented layers of sandstone and siltstone that contain strata of gray, calcareous sandstone or siltstone 1 to 4 inches thick, generally at a depth between 24 to 72 inches; calcareous; a few soft spots of lime.

The A horizon ranges from loam to silt loam. It is reddish brown to dark brown in hues of 2.5YR to 5YR. Reaction ranges from mildly alkaline to moderately alkaline and calcareous. The B horizon ranges from loam to silt loam. It ranges from reddish-brown to reddish yellow in hues of 2.5YR and 5YR. Reaction is mildly alkaline or moderately alkaline and calcareous. Small calcium carbonate concretions are common. The R horizon is at a depth between 10 and 20 inches. It ranges from reddish brown to reddish yellow in hues of 2.5YR and 5YR. Common in this horizon are thin seams, bands, and soft concretions of calcium carbonate. Also common, at a depth mainly between 2 and 6 feet, are stratified bands of calcareous, gray sandstone or siltstone that are 1 to 4 inches thick and about 1 foot apart.

Quinlan soils are less clayey than Vernon soils. They are more silty than Lucien soils and are shallower to bedrock than the nearby Woodward soils.

Quinlan-Wooddard complex, 5 to 12 percent slopes (QwD).—This complex consists of shallow and moderately deep, sloping to strongly sloping soils on uplands. The Quinlan soil makes up 40 to 60 percent of the mapped area and occurs on crests and convex side slopes of ridges. The Woodward soil makes up 20 to 40 percent of the unit and occurs below and between ridge crests and on concave side slopes. Making up 5 to 20 percent of the mapped areas is a soil that is similar to the Quinlan but is finer textured. Other areas consist of a severely eroded soil and of outcrops of rock, and these areas make up about 5 percent of the complex. Both the Quinlan and the Woodward soils in this complex have the profile described as representative of their respective series.

Depth to bedrock and strong slopes make these soils undesirable for cultivation. These soils are used mainly as native range, but some areas are used for tame pasture. Both parts in capability unit VIe–6, dryland, and in woodland suitability group 4; Quinlan part in Shallow Prairie range site; Woodward part in Loamy Prairie range site.

Reinach Series

The Reinach series consists of deep, nearly level or very gently sloping soils on terraces or uplands. These soils formed in alkaline, loamy sediment laid down by wind and water. The original vegetation was tall and mid grasses.

In a representative profile the surface layer is reddish-brown silt loam about 32 inches thick. At a depth between 32 and 62 inches is reddish-yellow, calcareous loam. Next is yellowish-red very fine sandy loam that is calcareous and extends to a depth of 72 inches.

These soils are well drained and are moderately permeable. Available water capacity is high, and intake rate is moderate.

Representative profile of Reinach silt loam, 0 to 1 percent slopes, in a cultivated field (1,320 feet east and 700 feet north of the southwest corner of sec. 32, T. 8 N., R. 13 W.):

Ap—0 to 12 inches, reddish-brown (5YR 5/3) silt loam, dark reddish brown (5YR 3/3) moist; weak, fine, granular structure; hard, friable; mildly alkaline; gradual, smooth boundary.

A12—12 to 32 inches, reddish-brown (5YR 5/3) silt loam, dark reddish brown (5YR 3/3) moist; moderate, medium, granular structure; hard, friable; neutral; gradual, smooth boundary.

C1—32 to 62 inches, reddish-yellow (5YR 6/6) loam, yellowish red (5YR 4/6) moist; massive; soft, friable; calcareous; gradual, smooth boundary.

C2—62 to 72 inches, yellowish-red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; massive; soft, friable; calcareous.

The Ap horizon generally is silt loam, but it ranges to loam. Its color ranges from reddish brown to dark brown in hues of 5YR and 7.5YR. Reaction is slightly acid to mildly alkaline. The A12 horizon ranges from loam to silt loam and from reddish brown to dark reddish brown in hue of 5YR. Reaction is neutral to moderately alkaline. On low benches the soils are calcareous at a depth between 20 and 40 inches. On high benches, however, the soils generally are leached of free carbonates to a depth of more than 40 inches. The C horizon ranges from very fine sandy loam to clay loam, but the finer texture generally occurs in thin strata between layers of sandier material. Its color ranges from reddish brown to red and yellowish red. Reaction is mildly alkaline or is moderately alkaline and calcareous.

Reinach soils are less clayey in the lower part of the A horizon and in the upper part of the C horizon than McLain soils. They are less stratified than Port soils and more silty than Yahola soils.

Reinach silt loam, 0 to 1 percent slopes (RhA).—This nearly level soil occurs on terraces. It has the profile described as representative of the Reinach series.

Included with this soil in mapping are small areas of Port silt loam and of Noble fine sandy loam. Also included are small areas of McLain silty clay loam and a few, short, steep, narrow areas along bench breaks.

Nearly all of the acreage of this soil is cultivated. The main crops are alfalfa, small grains, cotton, peanuts, and grain sorghum. Some areas are used for tame pasture or for native range. Capability unit I–1, dryland, and I–1, irrigated; Loamy Bottomland range site; woodland suitability group 1.

Reinach silt loam, upland, 0 to 1 percent slopes (ReA).—This nearly level soil is on uplands. Included in mapping are small areas of Pond Creek silt loam and small areas of a soil that has a winnowed surface layer of fine sandy loam less than 5 inches thick.

This soil is used mainly for such crops as small grains, peanuts, grain sorghum, cotton, and alfalfa. Some areas are used for tame pasture and native range. Capability unit I–2, dryland, and I–1, irrigated; Loamy Prairie range site; woodland suitability group 1.

Reinach silt loam, upland, 1 to 3 percent slopes (ReB).—This very gently sloping soil occurs on uplands. Included in mapping are a few small areas of Pond Creek silt loam and of Pond Creek fine sandy loam. Also included are small areas of Minco silt loam.

Nearly all of the acreage of this soil is cultivated. The chief crops are small grains, grain sorghum, alfalfa, cotton, and peanuts. Some areas are used for tame pasture or native range. Capability unit IIe–1, dryland, and IIe–1, irrigated; Loamy Prairie range site; woodland suitability group 1.

Rock Outcrop

In this county Rock outcrop is mapped only as part of Talpa-Rock outcrop complex, 5 to 30 percent slopes (TaE). This land type consists of limestone rock that is tilted at an angle of about 45 degrees. Height of the outcrops ranges from 6 to 24 inches, and width from 12 to 36 inches. These outcrops are several hundred feet long, generally in an upslope and downslope direction, and they give the effect of rows of rock. The rows are 4 to 8 feet apart.

Rough Broken Land

Rough broken land (Ro) is a mixture of soil material and exposed sandstone or limestone. It occurs in canyon drainageways or on canyon walls. The composition of this unit is more variable than that of other units in the county but has been controlled well enough for the expected use of the soil material.

About 40 to 60 percent of the mapped areas are made up of soil material that is 2 to 10 inches thick and is on canyon walls. Here slopes are 20 to 75 percent. About 25 to 50 percent of the mapped areas are made up of exposed nearly vertical walls of sandstone or limestone. The remaining 10 percent of the mapped areas consists of a mixture of colluvium and alluvium, 10 to 48 inches thick, on the floor below the canyon walls.

The native vegetation on Rough broken land ranges from mid to tall grasses. Steep slopes make much of this unit poorly suited to grazing by livestock. Capability unit VIIs–3, dryland; Breaks range site; woodland suitability group 4

Shellabarger Series

The Shellabarger series consists of deep, very gently sloping to gently sloping soils on uplands. These soils formed under a cover of tall and mid grasses in loamy sediment laid down by wind and water.

In a representative profile the surface layer is reddish-brown fine sandy loam about 9 inches thick. At a depth between 9 and 27 inches is reddish-brown sandy clay loam that has granular and prismatic structure. Next, at a depth between 27 and 76 inches, is red fine sandy loam that has granular structure. Below is reddish-brown clay loam.

Shellabarger soils are well drained and are moderately permeable. Available water capacity is high, and intake rate is moderate.

Representative profile of Shellabarger fine sandy loam, 3 to 5 percent slopes, in a cultivated field (150 feet east and 90 feet south of the northwest corner of sec. 6, T. 10 N., R. 13 W.):

Ap—0 to 9 inches, reddish-brown (5YR 4/3) fine sandy loam, dark reddish brown (5YR 3/3) moist; weak, medium, granular structure; soft, very friable; many roots; many pores; slightly acid; clear, smooth boundary.

B2t—9 to 27 inches, reddish-brown (2.5YR 5/4) sandy clay loam, dark reddish brown (2.5YR 3/3) moist; weak, coarse, prismatic structure that parts to weak, medium, granular; slightly hard, friable; patchy clay films on ped faces; neutral; diffuse, smooth boundary.

B3—27 to 76 inches, red (2.5YR 4/6) fine sandy loam, dark red (2.5YR 3/6) moist; weak, medium, granular structure; slightly hard, friable; a few roots; sand grains coated and bridged; neutral; diffuse, smooth boundary.

IIBb—76 to 100 inches, reddish-brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; moderate, medium, granular structure; very hard, friable; neutral.

The A horizon generally is fine sandy loam, but it ranges to loamy fine sand in a few winnowed areas. Its color ranges from reddish brown to brown in hues of 5YR to 7.5YR. Reaction is slightly acid or neutral. The B2t horizon ranges from fine sandy loam to sandy clay loam, and from reddish brown to yellowish red in hues of 2.5YR and 5YR. Reaction is slightly acid or neutral. The B3 horizon ranges from fine sandy loam to sandy clay loam and from reddish brown to yellowish red in hues of 2.5YR and 5YR. Reaction is neutral to mildly alkaline. At a depth below 5 feet, buried horizons are common.

Shellabarger soils are redder throughout and have a less silty B horizon than Minco soils. They are deeper than Cobb soils, and they have a less silty B horizon than Pond Creek soils.

Shellabarger fine sandy loam, 1 to 3 percent slopes (ShB).—This very gently sloping soil is on uplands. Included in mapping are a few small areas of Pond Creek fine sandy loam and of Cobb fine sandy loam. Also included are small areas of Konawa loamy fine sand.

Most of the acreage of this soil is cultivated. The main crops are alfalfa, cotton, grain sorghum, small grains, and peanuts. Some areas are used for tame pasture or native range. Capability unit IIe–2, dryland, and IIe–1, irrigated; Sandy Prairie range site; woodland suitability group 1.

Shellabarger fine sandy loam, 3 to 5 percent slopes (ShC).—This gently sloping soil is on uplands. It has the profile described as representative of the Shellabarger series.

Included with this soil in mapping are small areas of Cobb fine sandy loam and a few areas of Pond Creek fine sandy loam. Also included are small areas of Konawa loamy fine sand.

Most of the acreage of this soil is cultivated. The main crops are alfalfa, small grains, grain sorghum, cotton, and peanuts. Only a small part of the total acreage of this soil is used for native range. Capability unit IIIe-2, dryland, and IIIe-1, irrigated; Sandy Prairie range site; woodland suitability group 2.

Talpa Series

The Talpa series consists of very shallow, sloping to steep soils on uplands. These soils formed under a vegetative cover of short and mid grasses in material weathered from limestone.

In a representative profile the surface layer is very dark grayish brown and dark grayish-brown silt loam that is about 8 inches thick and is 10 to 35 percent limestone fragments. Below is light-gray limestone.

These soils are well drained and are moderately permeable. Available water capacity is low, and intake rate is moderate.

Representative profile of a Talpa silt loam from an area in Talpa-Rock outcrop complex, 5 to 30 percent slopes, in native range (1,320 feet north of the southwest corner of sec. 2, T. 5 N., R. 13 W.):

A11—0 to 4 inches, very dark grayish-brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; moderate, fine, granular structure; slightly hard, friable; many roots; many pores; 10 to 35 percent fragments of gray limestone that average 2 inches in diameter; moderately alkaline; gradual, smooth boundary.

A12—4 to 8 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; slightly hard, friable; many roots; many pores; a few calcareous spots near lower boundary; 20 to 35 percent fragments of gray limestone that average 2 inches in diameter; moderately alkaline; abrupt, wavy boundary.

R—8 inches +, light-gray (10YR 7/1) limestone, gray (10YR 6/1) moist.

The A horizon ranges from silt loam to silty clay loam. Its color ranges from brown to very dark grayish brown in hues of 7.5YR and 10YR. The A12 horizon is lacking in some areas, especially where the solum is thin. Reaction is mildly alkaline or moderately alkaline. Fragments of gray limestone that average 2 inches in diameter range from 10 to 35 percent. Fewer fragments are in the A11 horizon than in the A12 horizon. Depth to bedrock is less than 10 inches.

Talpa soils have a more uniform depth to bedrock than Limestone cobbly land and have fewer fragments on the surface. They are shallower to bedrock than Lucien and Vernon soils. Talpa soils are more silty than Lucien soils and less clayey than Vernon soils.

Talpa-Rock outcrop complex, 5 to 30 percent slopes (TaE).—This is the only mapping unit in the Talpa series mapped in the county. This soil and Rock outcrop are sloping to steep and occur on uplands. They occur in such an intricate pattern that it is impractical to map each soil and land type separately. Talpa soil makes up 70 to 85 percent of this complex, and Rock outcrop makes up 15 to 30 percent.

The Talpa soil in this unit has the profile described as representative of the Talpa series.

The Rock outcrop part of this unit consists of limestone bedrock. Talpa soil occurs between the rows.

This mapping unit is used as native range. A commercial limestone quarry is operating in an area of this unit. Capability unit VIIs-4, dryland; Edgerock range site; woodland suitability group 4.

Tillman Series

The Tillman series consists of deep, very gently sloping or gently sloping soils on uplands. These soils formed under a cover of mid and short grasses.

In a representative profile the surface layer consists of brown silty clay loam about 8 inches thick. Below, to a depth of about 12 inches, is reddish-brown silty clay loam. At a depth between 12 and 38 inches is reddish-brown silty clay. Next is red silty clay.

These soils are well drained and are very slowly permeable. Available water capacity is high, and intake rate is low. During dry periods the soil cracks to the surface.

Representative profile of Tillman silty clay loam, 3 to 5 percent slopes, in a native pasture (400 feet east and 50 feet north of the southwest corner of sec. 32, T. 7 N., R. 12 W.):

A1—0 to 8 inches, brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure; hard, friable; slightly sticky; neutral; clear, smooth boundary.

B1—8 to 12 inches, reddish-brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/3) moist; moderate, medium, granular structure; hard, friable, sticky; neutral; clear, smooth boundary.

B21t—12 to 22 inches, reddish-brown (2.5YR 4/4) silty clay, dark reddish brown (2.5YR 3/4) moist; moderate, medium, subangular blocky structure; extremely hard, firm, very sticky; thin continuous clay films on ped faces; mildly alkaline; gradual, smooth boundary.

B22t—22 to 38 inches, reddish-brown (2.5YR 5/4) silty clay, reddish brown (2.5YR 4/4) moist; moderate, medium, subangular blocky structure; extremely hard, firm, very sticky; continuous clay films on ped faces; calcareous; a few calcium carbonate concretions; gradual, smooth boundary.

B23t—38 to 48 inches, red (2.5YR 5/6) silty clay, red (2.5YR 4/6) moist; weak, medium, blocky structure; very hard, firm, very sticky; patchy clay films on ped faces; calcareous; about 5 percent calcium carbonate concretions; gradual, smooth boundary.

B3—48 to 60 inches, red (2.5YR 5/6) silty clay, red (2.5YR 4/6) moist; weak, medium, blocky structure; very hard, firm, very sticky; calcareous.

The A horizon is chiefly silty clay loam, but it ranges to silt loam. Its color ranges from brown to dark reddish brown in hues of 5YR and 7.5YR. Reaction is slightly acid or neutral. The B2t horizon ranges from silty clay loam to clay, and its color ranges from reddish brown to dark reddish brown in hues of 2.5YR and 5YR. The reaction is neutral to moderately alkaline. A few concretions of calcium carbonate occur at a depth between 15 and 30 inches. The B3 horizon ranges from silty clay loam to clay in texture, and from reddish brown to red and yellowish red in color.

Tillman soils, unlike Foard soils, have a silty clay loam B1 horizon. They have a redder Bt horizon than Hollister soils, and they are deeper than Vernon soils.

Tillman silty clay loam, 1 to 3 percent slopes (TlB).—This very gently sloping soil is on uplands. Included in mapping are a few small areas of Foard silt loam, and of Hollister silt loam.

Most of the acreage of this soil is cultivated. The main crops are small grains, cotton, alfalfa, and grain sorghum. Some small areas are used for native range. Capability unit IIIe-5, dryland, and IIIe-3, irrigated; Hardland range site; woodland suitability group 3.

Tillman silty clay loam, 3 to 5 percent slopes (TlC).—This gently sloping soil is on uplands. It has the profile described as representative of the Tillman series.

Included with this soil in mapping are a few small areas of Limestone cobbly land and Vernon soils. Also included are small areas of Rock outcrop.

Most of the acreage of this unit is cultivated. Small grains, grain sorghum, and cotton are the main crops. Some areas are used for native range. Capability unit IVe–7, dryland, and IVe–3, irrigated; Hardland range site; woodland suitability group 3.

Tillman silty clay loam, 2 to 5 percent slopes, eroded (TlC2).—This very gently sloping to gently sloping soil is on uplands. It is adjacent to drainageways and on the sides of hills. Part of the original surface layer has been removed by erosion. The present surface layer, which is 1 to 5 inches thick, is a mixture of the remaining surface layer and of material from the underlying layers. Rills and shallow gullies are common.

Included with this soil in mapping are a few areas of an uneroded Tillman silty clay loam, areas of slick spots, and areas of Vernon soils. Also included, and making up as much as 40 percent of the mapped areas, is a soil that is not so dark and thick as this Tillman soil. A few small areas of Rock outcrop also are included.

Most of the acreage of this soil is cultivated. The main crops are grain sorghum, small grains, and cotton. Some areas have been seeded to native grasses. Capability unit IVe–8, dryland, and IVe–3, irrigated; Hardland range site; woodland suitability group 4.

Vernon Series

The Vernon series consists of moderately deep, sloping to strongly sloping soils on uplands. These soils formed under mid grasses in material weathered from clay and shale.

In a representative profile the surface layer is reddish-brown clay about 7 inches thick. The next layers are reddish-brown clay about 48 inches thick. Gray limy siltstone occurs at erratic depths, but mostly at a depth of about 4 feet.

These soils are well drained and have slow permeability. Available water capacity is high, and intake rate is low.

Representative profile of a Vernon clay in Vernon soils, 5 to 12 percent slopes, in a native pasture (50 feet north and 2,010 feet west of the southeast corner of sec. 33, T. 6 N., R. 13 W.):

A—0 to 7 inches, reddish-brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; weak, medium, blocky structure; very hard, firm; matrix noncalcareous; a few fine calcium carbonate concretions; mildly alkaline; gradual, smooth boundary.

B—7 to 16 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; weak, fine, blocky structure; very hard, very firm; calcareous; calcium carbonate concretions; moderately alkaline; gradual, smooth boundary.

C1—16 to 48 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; massive; very hard, very firm; calcareous; moderately alkaline; abrupt, wavy boundary.

IIC2—48 to 72 inches, gray (N 5/0) limy siltstone in horizontal strata 6 inches to 36 inches thick and at a depth of about 48 inches from the surface.

The A horizon ranges from clay loam to clay. Its color ranges from reddish gray to reddish brown in hues of 2.5YR to 5YR. Reaction is mildly alkaline or moderately alkaline and calcareous. The B horizon is heavy silty clay loam to clay in texture and reddish brown to red in hue of 2.5YR. Reaction is mildly alkaline or moderately alkaline and calcareous. The C horizon ranges from silty clay loam to clay and includes layers of siltstone or shale. These layers range from reddish brown to red in hue of 2.5YR, except for the gray siltstone layers that occur at varying depths.

Vernon soils are shallower to bedrock than Tillman soils. They are redder than the Foard and Hollister soils and are shallower to bedrock than those soils.

Vernon soils, 5 to 12 percent slopes (VeD).—These sloping to strongly sloping soils occur on uplands. The surface layer ranges from clay loam to clay. This is the only unit in the Vernon series mapped in the county.

Included with this unit in mapping are a few small areas of Tillman silty clay loam, and of Limestone cobbly land. Also included are small eroded areas of Tillman silty clay loam.

These soils are not suited to cultivated crops, and most of the acreage is used for native range. Capability unit VIe–7, dryland; Red Clay Prairie range site; woodland suitability group 4.

Wing Series

The Wing series consists of deep, very gently sloping to gently sloping soils on uplands. These soils formed under mid and short grasses in material weathered from sandstone.

In a representative profile the surface layer is light-brown fine sandy loam about 6 inches thick. At a depth between 6 and 17 inches is reddish-brown clay loam that has a high content of sodium. Next, at a depth between 17 and 37 inches, is brown clay loam that has reddish, brownish, and grayish mottles and a high sodium content. Below, to a depth of 80 inches, is pale-brown loam that contains yellowish, brownish, reddish, and grayish mottles.

Wing soils are somewhat poorly drained and are very slowly permeable. Available water capacity is high, and intake rate is low.

In this county Wing soils are mapped only in a complex with Grant soils. The Grant soils are described under the Grant series.

Representative profile of Wing fine sandy loam from an area of Grant-Wing complex, 1 to 5 percent slopes, in a native pasture (1,000 feet west of the southeast corner of sec. 18, T. 6 N., R. 12 W.):

A1—0 to 6 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 4/2) moist; weak, medium, granular structure; hard, friable; many roots; crust one-fourth inch thick; slightly acid; clear, smooth boundary.

B2t—6 to 17 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate, medium, prismatic and moderate, medium, subangular blocky structure; very hard, firm; a few white salt crystals on ped faces; calcareous; moderately alkaline; gradual, smooth boundary.

B3—17 to 37 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; about 30 percent reddish, brownish, and grayish mottles; weak, medium, subangular blocky structure; very hard; friable; a few salt crystals on ped faces; calcareous; moderately alkaline; gradual, smooth boundary.

C1—37 to 60 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) moist; 1 to 5 percent yellowish, grayish, and brownish mottles; massive; very hard, friable; calcareous; strongly alkaline; gradual, smooth boundary.

C2—60 to 80 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) moist; 20 to 40 percent reddish and grayish mottles; massive; very hard, friable; calcareous; strongly alkaline.

The A horizon ranges from fine sandy loam to clay loam. Its color ranges from light reddish brown to brown in hues of 5YR to 10YR. Reaction is medium acid or slightly acid. The B2t horizon ranges from clay loam to silty clay loam. Its color ranges from reddish brown to pale brown in hues of 5YR to 10YR. Reaction is moderately alkaline or strongly alkaline. When dry, white salt crystals are on ped faces in this horizon. The B3 horizon ranges from clay loam to silty clay loam. Its color ranges from reddish brown to pale brown in hues of 5YR to 10YR. A few to many reddish-brown to gray mottles are in this horizon. The C horizon ranges from loam to clay loam in texture. It is dominantly pale brown in hue of 10YR and has a few to many distinct reddish to grayish mottles. Reaction is strongly alkaline and calcareous. In places, sandstone is at a depth between 42 and 90 inches or more.

These soils are outside the defined range of the Wing series. They contain slightly less than 35 percent clay in the upper 20 inches of the Bt horizon, but they are enough like the Wing series in morphology, composition, and behavior that a new series is not warranted.

Wing soils, unlike the Grant and Cobb soils, are mottled below the surface layer.

Woodward Series

The Woodward series consists of moderately deep, gently sloping to strongly sloping soils on uplands. These soils formed under a cover of mid and tall grasses in material weathered from calcareous sandstone and siltstone.

In a representative profile the surface layer is reddish-brown silt loam about 8 inches thick. It is underlain at a depth between 8 and 24 inches by reddish-brown silt loam. Below is reddish sandstone or siltstone.

Woodward soils are well drained and are moderately permeable. Available water capacity is high, and intake rate is moderate.

Representative profile of a Woodward silt loam from an area of Woodward-Quinlan complex, 3 to 5 percent slopes, in a cultivated field (230 feet west and 50 feet north of the southeast corner of the northeast quarter of sec. 12, T. 6 N., R. 11 W.):

Ap—0 to 8 inches, reddish-brown (5YR 5/4) silt loam, dark reddish brown (5YR 3/4) moist; weak, fine, granular structure; slightly hard, friable, slightly sticky; calcareous; moderately alkaline; clear, smooth boundary.

B—8 to 24 inches, reddish-brown (2.5YR 5/4) silt loam, dark reddish brown (2.5YR 3/4) moist; moderate, medium, granular structure; hard, friable, slightly sticky; many roots; many pores; common insect casts; calcareous; moderately alkaline; gradual, smooth boundary.

R—24 to 48 inches, red (2.5YR 5/6) weakly cemented siltstone and sandstone, red (2.5YR 4/6) moist; massive; hard; calcareous; a few concretions of calcium carbonates.

The A horizon ranges from loam to silt loam. Its color ranges from reddish brown and dark reddish brown to brown and dark brown in hues of 2.5YR to 7.5YR. Reaction ranges from neutral to moderately alkaline and calcareous. The B horizon ranges from loam to silt loam and from reddish brown to yellowish red in hues of 2.5YR and 5YR. Reaction is mildly alkaline or moderately alkaline, and this horizon generally is calcareous. The R horizon is weakly cemented sandstone and siltstone. Depth to the R horizon is between 20 and 36 inches. This horizon ranges from reddish brown and red to yellowish red and reddish yellow in hues of 2.5YR and 5YR. Thin seams, bands, and spots of calcium carbonate are common. Reaction is mildly alkaline or moderately alkaline.

Woodward soils are deeper to sandstone than Quinlan soils. They are shallower to bedrock, have a less clayey B horizon, and are more alkaline than the Grant soils. Woodward soils have a more clayey B horizon and are more alkaline than Dill soils.

Woodward-Quinlan complex, 3 to 5 percent slopes (WuC).—This is the only unit of the Woodward series mapped in the county. It consists of gently sloping soils on uplands. The Woodward soil, which is below and between the crests of hills and on concave side slopes, makes up 30 to 50 percent of the mapped areas. The Quinlan soil, on the crest of hills and on most convex side slopes, makes up 25 to 45 percent of the mapped areas. About 10 percent of the mapped areas consist of small areas of a Grant loam. Making up about 2 percent is a soil similar to Woodward but that has more clayey underlying layers.

Most of the acreage of this complex is cultivated. The main crops are peanuts, small grains, cotton, and grain sorghum. Some areas have been seeded to native grasses, and some areas are used as tame pasture or as native range. Both parts in capability unit IVe–1, dryland, and IVe–1, irrigated, and in woodland suitability group 3; Woodward part in Loamy Prairie range site; Quinlan part in Shallow Prairie range site.

Yahola Series

The Yahola series consists of deep, nearly level soils on flood plains. These soils formed in alluvium. They are subject to flooding. The original vegetation was tall and mid grasses and trees.

In a representative profile the surface layer is reddish-brown fine sandy loam about 11 inches thick. The next layer, at a depth between 11 and 48 inches, is reddish-brown fine sandy loam that is stratified below a depth of 36 inches. At a depth between 48 and 60 inches is yellowish-red fine sandy loam. This layer is underlain by reddish-brown clay loam that is stratified.

Yahola soils are well drained. Permeability is moderately rapid. Available water capacity is high, and intake rate is moderate.

Representative profile of Yahola fine sandy loam from an area of Yahola soils, in a cultivated field (2,640 feet south and 300 feet east of the northwest corner of sec. 5, T. 7 N., R. 12 W.):

Ap—0 to 11 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak, very fine, granular structure; soft, very friable; porous; calcareous; clear, smooth boundary.

C1—11 to 36 inches, reddish-brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; massive; hard, friable; calcareous; clear, smooth boundary.

C2—36 to 48 inches, reddish-brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; massive; hard, friable; thin bedding planes are evident; calcareous; clear, smooth boundary.

C3—48 to 60 inches, yellowish-red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; massive; slightly hard, very friable; thin bedding planes are evident; calcareous; clear, smooth boundary.

C4—60 to 64 inches, reddish-brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; massive; very hard, firm; bedding planes are evident; calcareous; clear, wavy boundary.

C5—64 to 72 inches, reddish-yellow (5YR 6/6) fine and medium sand, yellowish red (5YR 5/6) moist; single grain; soft, very friable; calcareous.

The A horizon ranges from loamy fine sand to clay loam, but it is mainly fine sandy loam. Its color ranges from reddish brown to dark brown in hues of 5YR and 7.5YR. The C horizon is stratified and has thin bedding planes in places. It is mostly

fine sandy loam, but it contains strata of fine sand to clay loam, especially at a depth below 40 inches. The color of the C horizon ranges from light reddish brown to yellowish red in hues of 2.5YR and 5YR.

Yahola soils are sandier throughout than McLain, Miller, Port, and Reinach soils. They are calcareous throughout, unlike Pulaski soils which are not calcareous in any part. They are redder throughout than Cyril soils.

Yahola soils (Ya).—This is the only unit in the Yahola series mapped in the county. These soils are flooded once in 1 to 5 years. Most slopes are less than 1 percent, but in a few small areas slopes are up to 4 percent.

Included with this soil in mapping are a few small areas of Port silt loam and of Pulaski soils. Also included are a few areas that are noncalcareous in the upper 15 inches.

Nearly all of the acreage of these soils is cultivated. The main crops are small grains, cotton, grain sorghum, alfalfa, and peanuts. Some areas are used for tame pasture or native range. Capability unit IIw-1, dryland, and IIw-1, irrigated; Loamy Bottomland range site; woodland suitability group 1.

Use and Management of the Soils

The soils of Caddo County are used mainly for cultivated crops, tame pasture, and native range. This section tells how the soils can be used for those main purposes, and also for windbreaks and post lots, for wildlife, and in building roads, farm ponds. and other engineering structures.

Managing Soils for Crops and Tame Pasture [2]

In this subsection management needed for all of the soils is discussed and the capability grouping used by the Soil Conservation Service is explained. Then the soils are placed in dryland capability units and in irrigated capability units and use and management for both kinds of units are described. Finally predicted yields of principal crops under two levels of management for dryland farming and for farming under irrigation are shown.

On the soils used for crops in Caddo County, management is needed for controlling wind and water erosion, maintaining the supply of organic matter, improving or maintaining tilth, and conserving moisture. Seasonal flooding on bottom lands of the Gracemont, Port, Pulaski, and Yahola soils also requires attention.

The increase in crop yields in recent years indicates that better plant varieties have been used and that effective measures for controlling erosion have been applied. Suitable practices for helping to control erosion are growing a winter cover crop; stripcropping; using a conservation cropping system that includes returning crop residues to the soil; stubble mulching; constructing terraces; farming on the contour; grassing of waterways; and applying fertilizer where needed. Practices for the control of insects and plant diseases are also needed.

Tame pasture occupies a large acreage in Caddo County, and it is an important source of forage for the county's livestock industry. Many acres of pasture plants provide year-round grazing for livestock when combined with native range and supplemental pastures.

[2] M. D. Gamble, conservation agronomist, Soil Conservation Service, assisted in the preparation of this section.

Bermudagrass is best suited to the deep soils on bottom lands, such as the fine sandy loams of the Pulaski and the Yahola series or the silt loams of the Port and Reinach series. Weeping lovegrass is also used extensively for tame pasture and is grown on the soils of the uplands.

Management of tame pasture is needed for controlling erosion and for furnishing a dependable and economical source of forage. Soil deficiencies can be determined by soil tests. Then a plant-food program can be used that is suited to the pasture plants and that gives the level of production desired. Production can be maintained for a long period if grazing is regulated and brush and weeds are controlled.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or engineering.

In the capability system, all kinds of soils are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes. (None in Caddo County.)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-2 or IIIe-3. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in Caddo County are described and suggestions for the use and management of the soils are given.

Management by Dryland Capability Units

In the following pages, the capability units, or groups of soils similar in management requirements for dryland farming, are described; some limitations are given; and suitable management is discussed. To find the names of all the soils in these capability units, refer to the "Guide to Mapping Units" at the back of this survey.

Under dryland farming conserving as much moisture as possible and using it efficiently are the main concerns of management. Practices therefore are needed that decrease runoff, increase infiltration, prevent excessive evaporation, and increase or maintain the content of organic matter. Controlling erosion is also important.

Capability unit I-1, dryland

This unit consists of deep, nearly level, well-drained soils on terraces. These soils have a loamy surface layer. The underlying layers are loamy or clayey. If these soils are left unprotected, a crust forms on the surface after heavy rains.

The soils in this unit are suited to alfalfa, cotton, small grains, grain sorghum, and peanuts. They are also suited to tame pasture, range, and woodland.

Management is needed that improves soil structure and fertility. Suitable practices are using all crop residues, growing cover crops, keeping tillage to a minimum, and applying fertilizer.

Capability unit I-2, dryland

This unit consists of deep, nearly level, well-drained soils that are on uplands. These soils are loamy throughout. If they are left unprotected, a crust forms on the surface after heavy rains.

These soils are suited to peanuts, small grains, cotton, grain sorghum, and alfalfa. They are also suited to tame pasture, range, and woodland.

Management is needed that improves soil structure and fertility and protects the soils from erosion. Effective practices are selecting a suitable cropping system, stubble mulching, growing cover crops, keeping tillage to a minimum, and applying fertilizer. Growing a cover crop in winter in fields used for row crops helps to control soil blowing.

Capability unit I-3, dryland

Pond Creek fine sandy loam, 0 to 1 percent slopes, is the only soil in this unit. It is a deep, nearly level soil that is well drained and occurs on uplands. This soil is loamy throughout.

This soil is suited to small grains, peanuts, cotton, grain sorghum, and alfalfa. It is also suited to tame pasture, range, and woodland.

Maintaining and improving soil structure and fertility and controlling erosion are the chief concerns of management. Practices that are effective in maintaining fertility and controlling erosion are stubble mulching, rotating crops, fertilizing, and planting winter cover crops following row crops.

Capability unit IIe-1, dryland

This unit consists of deep, very gently sloping, well-drained soils on uplands. These soils are loamy throughout. If they are left unprotected, a crust forms on the surface after heavy rains.

These soils are suited to small grains, grain sorghum, cotton, alfalfa, and peanuts. They are also suited to tame pasture, range, and woodland.

Management is needed that maintains or improves soil structure and fertility and protects the soils from erosion.

Effective practices that conserve soil and water are growing small grains year after year and stubble mulching. If row crops are grown, terracing and contour farming help to reduce erosion. Growing alfalfa or other adapted legumes helps to maintain or improve soil structure and fertility.

Capability unit IIe-2, dryland

This unit consists of deep or moderately deep, very gently sloping, well-drained soils on uplands. These soils are loamy throughout.

The soils in this unit are suited to cotton, peanuts, small grains, and grain sorghum. They are also suited to tame pasture, range, and woodland.

Management is needed that controls erosion and maintains or improves soil structure and fertility. Soil blowing is a hazard if the surface is left bare.

A cropping system that includes maximum use of crop residue provides a protective cover to control soil blowing. Other ways of controlling soil blowing are using a cover crop of legumes following a harvest of peanuts or stubble mulching following a harvest of small grains. Terracing and contour farming help to control water erosion (fig. 6). Changing the depth of tillage reduces the formation of a plowpan. Crops on these soils respond if fertilizer is applied.

Capability unit IIc-1, dryland

Hollister silt loam, 0 to 1 percent slopes, is the only soil in this unit. It is a deep, nearly level, well-drained soil that occurs on uplands. The surface layer is loamy, and it is underlain by loamy or clayey material. If this soil is left unprotected, a crust forms on the surface after heavy rains.

This soil is suited to small grains, cotton, grain sorghum, and alfalfa. It is also suited to range and woodland.

Maintaining or improving soil structure and fertility and controlling erosion are the chief concerns of management on this soil. Growing crops that are high in residue, returning the residue to the soil, and stubble mulching are ways of improving soil structure and fertility. The residue also helps to conserve moisture and to control erosion. Controlling weeds, keeping tillage to a minimum, adding fertilizer, and terracing are other practices that can be used on this soil.

Capability unit IIs-1, dryland

Foard silt loam, 0 to 1 percent slopes, is the only soil in this unit. It is a deep, nearly level, moderately well drained soil that occurs on uplands. The surface layer is loamy, and it is underlain by clayey or loamy material that is high in sodium. If this soil is left unprotected, a crust forms on the surface after heavy rains.

The soil in this unit is suited to small grains, grain sorghum, alfalfa, and cotton. It is also suited to range and woodland.

Management is needed that maintains or improves soil structure and fertility and reduces surface crusting.

Growing crops that produce large amounts of residue, such as small grains, and working the residue into the soil helps to control erosion, breaks up surface crusting, and increases water intake. On long slopes terraces help to reduce runoff.

Capability unit IIw-1, dryland

This unit consists of deep, nearly level, well-drained soils that are on flood plains. These soils have a loamy or sandy surface layer. The layers below are loamy. These soils are subject to flooding once in 1 to 5 years.

The soils in this unit are suited to cotton, grain sorghum, alfalfa, peanuts, and small grains. They are also suited to tame pasture, range, and woodland (fig. 7).

Maintaining or improving soil structure and fertility and controlling damaging floods and erosion are the main concerns of management. Using crop residue helps to maintain soil structure and fertility. Growing a cover crop in winter in fields used for row crops helps to control soil blowing.

Capability unit IIw-2, dryland

Port silt loam is the only soil in this unit. It is a deep, nearly level, well-drained soil that occurs on flood plains.

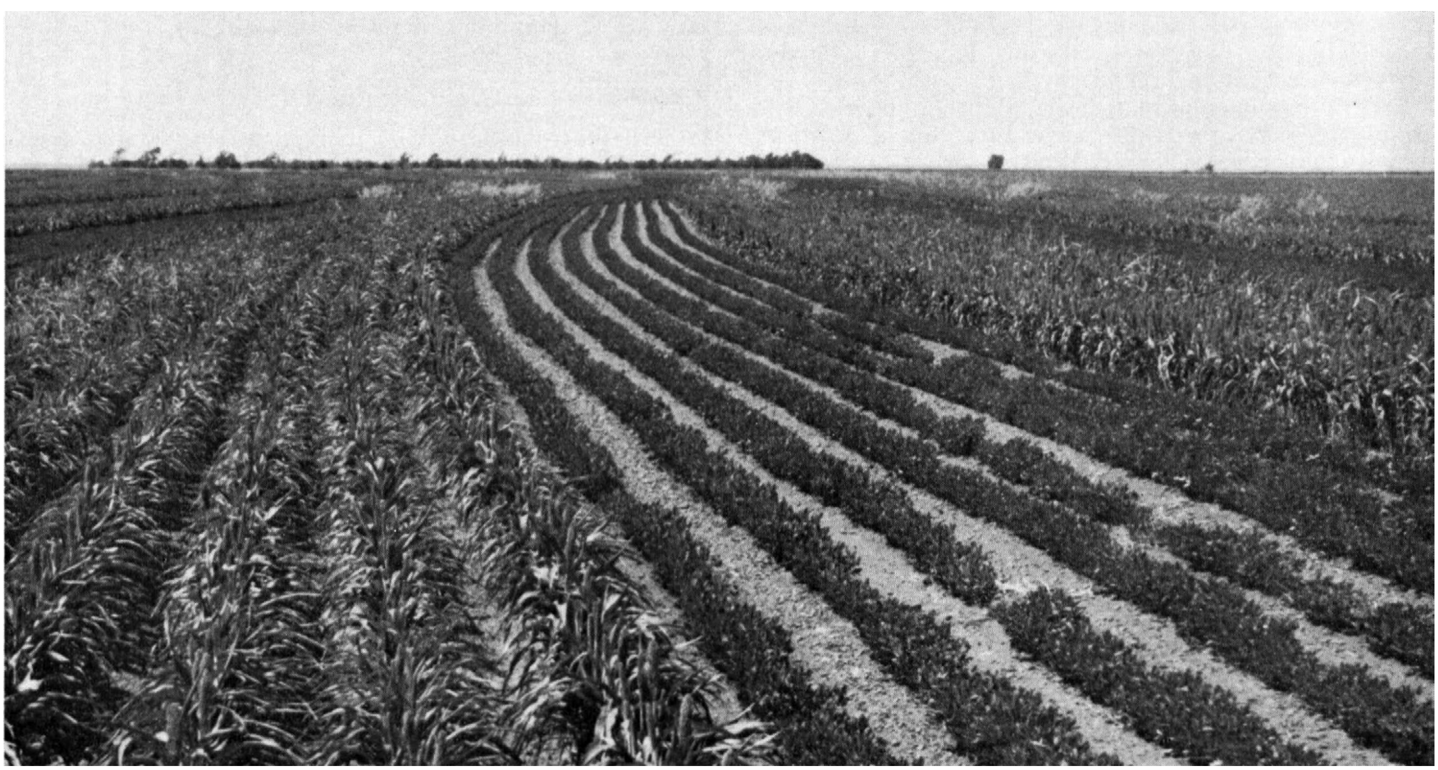

Figure 6.—**Contour stripcropping of grain sorghum and peanuts on a Pond Creek fine sandy loam in capability unit IIe-2, dryland.** (*Courtesy of Bureau of Indian Affairs, U.S. Dept. Int.*)

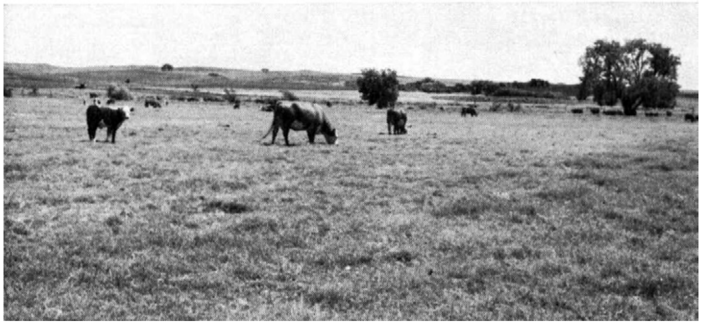

Figure 7.—**Cattle grazing bermudagrass on Yahola soils in capability unit IIw-1, dryland. (*Courtesy of Bureau of Indian Affairs, U.S. Dept. Int.*)**

This soil is subject to flooding once in 1 to 5 years. It is loamy throughout. If the soil is left unprotected, a crust forms on the surface after heavy rains.

This soil is suited to small grains, alfalfa, cotton, grain sorghum, and peanuts. It is also suited to tame pasture, range, and woodland.

Suitable management is needed to protect this soil from damaging floods and to maintain or improve soil structure and fertility. Flooding can be reduced by use of protective measures on all areas, by use of watershed protection projects placed upstream for flood control, and by farm ponds. In cultivated areas an effective practice is the growing of small grains and other crops that produce large amounts of residue and working the residue into the soil. Growing legumes in the cropping system also is a means of maintaining or improving soil fertility.

Capability unit IIIe-1, dryland

This unit consists of deep, gently sloping, well-drained soils that are on uplands. These soils are loamy throughout. If they are left unprotected, a crust forms on the surface after heavy rains.

The soils in this unit are suited to small grains, cotton, grain sorghum, peanuts, and alfalfa. They are also suited to tame pasture, range, and woodland.

Controlling water erosion and maintaining or improving soil structure and fertility are the chief concerns of management on these soils.

In cultivated areas an effective practice is the growing of crops that produce large amounts of residue and working the residue into the soil. The residue helps to reduce erosion and to maintain the content of organic matter. It also increases intake of water and helps to improve tilth. Erosion can be controlled by selecting a suitable cropping system. An example is one in which a soil-depleting crop, such as cotton, is followed in winter by a cover crop. Terraces, contour farming, and grassed waterways also help to control erosion.

Capability unit IIIe-2, dryland

This unit consists of deep and moderately deep, gently sloping, well-drained soils that are on uplands. These soils are loamy throughout.

The soils in this unit are suited to cotton, grain sorghum, small grains, and peanuts. They are also suited to tame pasture, range, and woodland.

Management is needed that controls erosion and maintains soil fertility. Effective practices are growing soil-improving crops and crops that produce large amounts of residue. Stubble mulching, terracing, cultivating on the contour, and using grassed waterways are other effective management practices.

Capability unit IIIe-3, dryland

Pond Creek silt loam, 1 to 3 percent slopes, eroded, is the only soil in this unit. It is a deep, well-drained, very gently sloping, eroded soil on uplands. This soil is loamy throughout. If left unprotected, a crust forms on the surface after heavy rains.

This soil is suited to small grains, grain sorghum, cotton, and peanuts. It is also suited to tame pasture, range, and woodland.

Controlling water erosion and maintaining or improving soil structure and fertility are the chief concerns of management on this soil. In cultivated areas an effective practice is the growing of crops that produce large amounts of residue and working the residue into the soil. The residue helps to reduce water erosion and to maintain the content of organic matter. It also increases intake of water and helps to improve tilth. Terracing and contour tillage help to control runoff.

Capability unit IIIe-4, dryland

Dougherty loamy fine sand, 1 to 3 percent slopes, is the only soil in this unit. It is a deep, well-drained, very gently sloping soil that occurs on uplands. The surface layer is sandy, and it is underlain by loamy material.

This soil is suited to cotton, grain sorghum, peanuts, and small grains. It is also suited to tame pasture, range, and woodland.

Management is needed that improves fertility and helps to control soil blowing. In cultivated areas an effective practice is the growing of crops that produce large amounts of residue and working the residue into the soil. The residue helps to reduce soil blowing and to maintain the content of organic matter. It also increases intake of water and helps to improve tilth. Delaying tillage in spring during the period of critical soil blowing helps to maintain a vegetative cover.

Capability unit IIIe-5, dryland

Tillman silty clay loam, 1 to 3 percent slopes, is the only soil in this unit. It is a deep, well-drained, very gently sloping soil that occurs on uplands. The surface layer is loamy, and it is underlain by clayey or loamy material. If this soil is left unprotected, a crust forms on the surface after heavy rains.

This soil is suited to small grains, cotton, and grain sorghum. It is also suited to range and woodland.

Management is needed that increases water intake, maintains or improves soil structure, and controls water erosion. In cultivated areas an effective practice is the growing of crops that produce large amounts of residue and working the residue into the soil. The residue helps to reduce runoff and to increase intake of water and storage of moisture. A suitable cropping system is one of row crops that are low in residue followed by cover crops in winter. Terraces help to control erosion.

Capability unit IIIw-1, dryland

Miller silty clay loam is the only soil in this unit. This soil is deep, nearly level, and well drained or moderately well drained. It is on flood plains and is subject to flooding once in 5 to 20 years. The surface layer is loamy, and it is

underlain by clayey or loamy material. If this soil is left unprotected, a crust forms on the surface after heavy rains.

This soil is suited to small grains, grain sorghum, cotton, and alfalfa. It is also suited to tame pasture and to range.

Improving soil structure and removing excess water from low areas are the chief concerns of management on this soil. Returning all crop residue and growing deep-rooted legumes are ways of improving soil structure and fertility. Flooding can be reduced by use of such flood-control practices upstream as watershed protection projects, detention dams, and channel improvement.

Capability unit IVe-1, dryland

This unit consists of deep, moderately deep and shallow, gently sloping to sloping, well-drained soils on uplands. These soils are loamy throughout.

The soils in this unit are suited to small grains, grain sorghum, and cotton. They are also suited to tame pasture, range, and woodland. Small areas are used for peanuts.

Management is needed that controls water erosion and maintains or improves soil structure. In cultivated areas an effective practice is the growing of crops that produce large amounts of residue and returning all residue to the soil. This practice protects the soil from erosion and reduces crusting. A suitable cropping system that reduces runoff and maintains or improves soil structure is one of row crops followed by cover crops in winter. Other practices that reduce runoff are terracing, tilling on the contour, and using grassed waterways.

Capability unit IVe-2, dryland

Grant loam, 3 to 6 percent slopes, eroded, is the only soil in this unit. It is a deep, well-drained, gently sloping and sloping soil on uplands.

This soil is loamy throughout. The surface layer has been thinned by erosion, and the areas are cut by many rills and small gullies. If this soil is left unprotected, a crust forms on the surface after heavy rains.

This soil is suited to small grains, grain sorghum, tame pasture, range, and woodland. Management is needed that controls erosion and maintains or improves soil fertility. An effective practice is the growing of crops that produce large amounts of residue and returning all residue to the soil. The residue helps to reduce runoff and to increase the intake of water and amount of organic matter in the soil. Runoff can be reduced by terraces and contour tillage. Excess water can be carried from the fields to the desired areas by grassed waterways.

Capability unit IVe-3, dryland

In this unit are moderately deep, gently sloping to sloping, well-drained soils on uplands. These soils are loamy throughout.

The soils in this unit are suited to small grains, grain sorghum, cotton, and peanuts. They are also suited to tame pasture, range, and woodland.

Controlling soil blowing and maintaining or improving soil fertility are the chief concerns of management on these soils. Returning all crop residue to the soil helps to improve fertility. Erosion can be controlled by using terraces and contour tillage, which slow runoff and increase the intake of water. Crops on these soils respond to fertilizer.

Capability unit IVe-4, dryland

Cobb fine sandy loam, 3 to 8 percent slopes, eroded, is the only soil in this unit. This soil is moderately deep, gently sloping to sloping, and well drained, and is on uplands. It is loamy throughout. The surface layer has been thinned by erosion.

This soil is suited to small grains, grain sorghum, peanuts, and cotton. It is also suited to tame pasture, range, and woodland.

Management is needed that controls erosion and maintains or improves fertility. An effective practice is to grow crops that are high in residue. Leaving adequate amounts of the residue on the soil helps to control erosion, increases water intake, adds organic matter, and improves soil structure.

In cultivated areas, the use of terraces and contour tillage protect the soil from erosion. Grassed waterways are useful. Crops on this soil respond to fertilizer.

Capability unit IVe-5, dryland

This unit consists of deep, gently sloping to hummocky, well-drained and somewhat excessively drained soils. The soils are on uplands. Their surface layer is sandy and is underlain by sandy and loamy material.

These soils are suited to peanuts, grain sorghum, cotton, and small grains. They are also suited to tame pasture, range, and woodland.

Management is needed that controls erosion and maintains and improves fertility. An effective practice is the growing of crops that produce a large amount of residue and returning all residue to the soil. The residue helps to decrease erosion and to increase the intake of water and supply of organic matter. Soil blowing can be reduced if cover crops are grown in winter following the harvesting of row crops that leave little residue. Delaying tillage in spring during the period of critical soil blowing helps to maintain a vegetative cover. Crops on these soils respond to fertilizer.

Diversion terraces are needed to protect fields from water from higher lying areas. Excess water can be safely removed by using waterways and natural drainageways in which perennial grasses have been established. Field windbreaks are used in some areas for control of soil blowing.

Capability unit IVe-6, dryland

Konawa loamy fine sand, 1 to 5 percent slopes, eroded, is the only soil in this unit. It is a deep, very gently sloping to gently sloping, well-drained soil on uplands. The surface layer is sandy, and it is underlain by loamy material. In places material formerly in the underlying layers has been mixed with the remaining surface layer by plowing. Rills, small gullies, small areas of sandy deposition, and blowouts are characteristic.

This soil is suited to peanuts, grain sorghum, cotton, and small grains. It is also suited to tame pasture, range, and woodland.

Management is needed that controls erosion and maintains or improves fertility. An effective practice is the growing of crops high in residue and returning the residue to the soil. The residue helps to reduce runoff and erosion and to increase the intake of water and the amount of organic matter in the soil.

Diversion terraces are needed to protect this soil from water from higher lying areas. Waterways and natural drainageways ought to be established in permanent vegetation.

Capability unit IVe-7, dryland

Tillman silty clay loam, 3 to 5 percent slopes, is the only soil in this capability unit. It is a deep, well-drained, gently sloping soil on uplands. This soil has a loamy surface layer underlain by loamy or clayey material. If it is left unprotected, a crust forms on the surface after heavy rains.

This soil is suited to cotton, small grains, and grain sorghum. It is also suited to range and woodland.

Management is needed that controls water erosion and maintains or improves soil structure. An effective practice is the growing of crops high in residue and returning all the residue to the soil. The residue helps to reduce runoff and to increase the intake of water and the amount of organic matter in the soil. Using terraces and contour tillage decreases runoff and increases the intake of water. Natural drainageways and waterways need to be kept in perennial vegetation.

Capability unit IVe-8, dryland

Tillman silty clay loam, 2 to 5 percent slopes, eroded, is the only soil in this capability unit. It is a deep, very gently sloping to gently sloping, well-drained soil on uplands. It has a loamy surface layer and is underlain by loamy or clayey material. In areas not protected, a crust forms on the surface of this soil after heavy rains. The areas are marked by small gullies and rills.

This soil is suited to small grains, grain sorghum, and cotton. It is also suited to range.

Maintaining or improving soil structure and controlling water erosion are the chief concerns of management. Growing crops high in residue and using terraces and contour tillage are effective management practices. Returning all residue to the soil slows runoff and increases the intake of water. The residue also helps to maintain or improve soil structure and fertility. Establishing perennial grasses in waterways and natural drainageways helps to reduce further erosion. Crops on this soil respond to fertilizer.

Capability unit IVs-1, dryland

Only Grant-Wing complex, 1 to 5 percent slopes, is in this unit. These soils are deep, very gently sloping to gently sloping, and well drained and somewhat poorly drained. They are on uplands. The surface layer is loamy, and the underlying layers are loamy or clayey. Wing soils are affected by sodium. A crust forms on the surface of these soils after heavy rains if the areas are left unprotected.

The soils in this unit are suited to small grains, grain sorghum, and cotton. They are also suited to tame pasture, range, and woodland.

Management is needed that improves or maintains soil structure, reduces surface crusting and content of sodium, and controls erosion. An effective practice for reducing the sodium content is adding organic material and gypsum. If such materials are added, however, the soils should not be tilled for at least two growing seasons. Leaving residue on the surface provides organic material for improving or maintaining soil structure and fertility. The residue also protects the soils from erosion, reduces surface crusting, and increases the intake of water. Crops on these soils respond if fertilizer is applied.

Diversion terraces are needed in places on these soils to prevent damage from runoff water from higher lying areas. Natural drainageways should be established in perennial vegetation.

Capability unit IVs-2, dryland

Eufaula loamy fine sand, 1 to 3 percent slopes, is the only soil in this unit. This soil is deep, very gently sloping, and somewhat excessively drained and is on uplands. It is sandy throughout.

This soil is suited to grain sorghum, cotton, peanuts, and small grains. It is also suited to tame pasture, woodland, and range.

Controlling soil blowing and maintaining soil fertility are the main concerns of management. Returning all crop residue to the soil helps to reduce soil blowing. The residue also supplies organic material that maintains or improves fertility. Delaying tillage in spring during the critical period of soil blowing helps to maintain a vegetative cover. Winter cover crops should be planted following row crops. Crops on this soil respond to fertilizer.

Capability unit Vw-1, dryland

This unit consists only of Port and Pulaski soils, channeled. These soils are deep, nearly level or very gently sloping, and well drained. They are on flood plains. Gently sloping to steep soils in channels and on breaks are also in this unit. The soils in this unit are loamy throughout and are flooded more often than once every year.

These soils are suited to tame pasture, range, and woodland. The chief concern of management is protecting the areas from damaging floods. Flood damage can be reduced by use of flood-control practices upstream and by watershed protection projects.

Capability unit Vw-2, dryland

This unit consists only of Gracemont soils. These soils are deep, nearly level, and somewhat poorly drained. They are loamy throughout. These soils are on flood plains and are flooded more often than once each year. The water table is at a depth of less than 40 inches.

These soils are suited to tame pasture, range, and woodland. Protecting the soils from damaging floods, using watershed protection projects, and installing flood-control practices upstream are the major management practices needed.

Capability unit VIe-1, dryland

This unit consists of deep and moderately deep, sloping soils on uplands. These soils are loamy throughout.

The soils in this unit vary in characteristics and in slopes. The kind of vegetation that grows on the areas also varies. The soils therefore are better suited to range and to woodland than to other uses.

Management is needed that protects these soils from fire and that controls grazing and erosion. Maintaining a sufficient cover of grass to prevent erosion and to increase the intake of water is an effective practice for conserving soil and water.

Capability unit VIe-2, dryland

This unit consists only of Cobb and Grant soils, 3 to 8 percent slopes, severely eroded. These soils are moderately

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deep and deep, gently sloping to sloping, and well drained. They are on uplands. The soils are loamy throughout. Part of the original surface layer has been washed away and the underlying layers are exposed in more than 25 percent of the area. Gullies and rills are common.

These soils are suited to tame pasture and range. Management is needed that establishes vegetation and controls erosion. In addition the areas should be protected from fire, and grazing should be controlled.

Capability unit VIe–3, dryland

Only Darnell-Noble association, rolling, is in this unit. The soils in this unit are shallow and deep, rolling, and well drained. They are on uplands. These soils are loamy throughout.

The soils in this unit are suited to tame pasture and range. Management is needed that protects these soils from fire and controls grazing and erosion. Brush control also is needed to help increase the grazing potential. An effective practice is to maintain sufficient cover of grass to prevent erosion.

Capability unit VIe–4, dryland

This unit consists only of Konawa soils, 2 to 8 percent slopes, severely eroded. These soils are deep, very gently sloping to sloping, and well drained. They are on uplands. The surface layer is sandy, and the material below is loamy. In most places part of the original surface layer has been washed away, and the underlying sandy clay loam is exposed. The soils are marked by many rills, small gullies, and blown-out areas.

These soils are suited to tame pasture and to range. Many areas are seeded to native grasses, weeping lovegrass, or bermudagrass.

Management is needed that protects areas of these soils from fire, establishes grass in gullies, and controls grazing and brush. Diversion terraces can be used to remove excess water from higher lying areas. Keeping a cover of grass on the areas helps to conserve soil and water.

Capability unit VIe–5, dryland

This unit consists only of Lucien-Dill fine sandy loams, 3 to 12 percent slopes. These soils are shallow or moderately deep, gently sloping to strongly sloping, and well drained. They are on uplands. These soils are loamy throughout, and in a few areas rocks crop out. The shallow soils have low available water capacity.

These soils are suited to tame pasture, range, and woodland. They are used mainly for grazing, and nearly all of the acreage has a permanent cover of tall and mid grasses.

Protecting these soils from fire and controlling grazing and erosion are the chief concerns of management. Keeping a cover of grass on the areas helps to control erosion.

Capability unit VIe–6, dryland

Only Quinlan-Woodward complex, 5 to 12 percent slopes, is in this unit. These upland soils are shallow or moderately deep, sloping to strongly sloping, and well drained. They are loamy throughout, and rocks crop out in a few places. If these soils are left unprotected, a crust forms on the surface after heavy rains.

The soils in this unit are suited to tame pasture and range, and nearly all areas are in tall and mid native grasses. Management is needed that protects the areas from fire and that controls grazing and erosion. Keeping a cover of grass on the areas is an effective way of controlling erosion.

Capability unit VIe–7, dryland

This unit consists only of Vernon soils, 5 to 12 percent slopes. These soils are moderately deep, sloping to strongly sloping, and well drained. They are on uplands and are loamy or clayey throughout.

The soils in this unit are suited to range. Management is needed that protects the areas from fire and that controls grazing and erosion. Keeping a cover of grass on the areas helps to control erosion and to increase the intake of water.

Capability unit VIs–1, dryland

Eufaula fine sand, rolling, is the only soil in this unit. This upland soil is deep, rolling, and somewhat excessively drained. It is sandy throughout.

This soil is suited to tame pasture, range, and woodland, and it is mostly used for grazing. The native vegetation consists of post oak, blackjack oak, and mid and tall native grasses.

Protecting this soil from fire and controlling grazing and erosion are the chief concerns of management. Keeping a cover of grass on the areas helps to prevent erosion. Brush control provides for better growth of the more desirable native grasses.

Capability unit VIIe–1, dryland

This unit consists only of Darnell soils, 3 to 12 percent slopes, severely eroded. These soils are shallow, gently sloping to strongly sloping, and well drained. They are loamy throughout and are on uplands. Part of the original surface layer has been washed away, and in places the underlying material is exposed. Rills and sandstone outcrops are common.

These soils are suited to range. Management is needed that protects the areas from fire and that controls grazing and provides for brush control. Keeping a cover of grass on the areas helps to prevent further erosion.

Capability unit VIIe–2, dryland

Only Darnell-Noble association, hilly, is in this capability unit. These upland soils are shallow or deep and are well drained. They are loamy throughout, and sandstone crops out in many places.

The soils in this unit are suited to range. Management is needed that protects the areas from fire and that controls grazing and erosion. Keeping a cover of plants on the soils is an effective way of controlling erosion.

Capability unit VIIe–3, dryland

This unit consists only of Lucien-Dill fine sandy loams, 12 to 30 percent slopes. These soils on uplands are shallow and moderately deep, moderately steep and steep, and well drained. They are loamy throughout. Rocks crop out in many places.

These soils are suited to range. Management is needed that protects the areas from fire and that controls grazing and erosion. An effective practice that conserves soil and water is keeping a cover of grass on the areas.

Capability unit VIIs–1, dryland

Only Acme-Gypsum outcrop complex, 2 to 8 percent slopes, is in this capability unit. These upland soils are shallow to gypsum, are very gently sloping to sloping, and

are well drained. They are loamy throughout. Gypsum crops out in many places.

These soils are suited to range. Management is needed that protects the areas from fire and controls grazing and erosion. An effective practice that conserves soil and water is keeping a cover of grass on the areas.

Capability unit VIIs-2, dryland

Only Limestone cobbly land is in this capability unit. This land type is gently sloping to moderately steep and is on uplands. It consists of soil material that is shallow to limestone and is loamy throughout.

Limestone cobbly land is suited to range. Protecting the areas from fire and controlling grazing and erosion are the main concerns of management. Keeping a cover of grass on the areas helps to control erosion.

Capability unit VIIs-3, dryland

Only Rough broken land is in this capability unit. This land type is steep to very steep and is on uplands. It consists of exposed rock and soil material that is shallow to rock. The soil material is loamy throughout.

Rough broken land is suited to range. Management is needed that protects the areas from fire and controls grazing and erosion. An effective practice that conserves soil and water is keeping a cover of grass on the areas.

Capability unit VIIs-4, dryland

Only Talpa-Rock outcrop complex, 5 to 30 percent slopes, is in this unit. This complex consists of very shallow, sloping to steep, well-drained soils and of many rock outcrops. The soils are on uplands. They are loamy throughout.

This complex is well suited to range, though some areas are too steep for livestock to graze on them. Protecting the areas from fire and controlling grazing and erosion are the chief concerns of management. In addition brush must be removed. Keeping a cover of grass on the areas helps to control erosion.

Management by Irrigated Capability Units [3]

According to the 1959 Census of Agriculture, 421 farms in Caddo County were irrigated and they occupied 22,094 acres. By 1964, the number of irrigated farms had increased to 462 and they occupied 36,083 acres in the county. About 30,000 acres of peanuts is irrigated in the county (fig. 8). Other irrigated crops are cotton, alfalfa, grain sorghum, and bermudagrass.

Irrigation water in the county is obtained from wells, streams, farm ponds, and reservoirs. Most of the irrigation water comes from ground water pumped from wells drilled in the Rush Springs Sandstone (fig. 9). This formation is of Late Permian age, and about 1 gallon of water can be expected for each foot that is drilled into the formation. The Rush Springs Sandstone is made up of consolidated material, and only the unconsolidated material above the formation needs to be cased. Several wells in the county are in alluvial deposits of sand and gravel along the Washita River. Most of the wells in the county are in the community north of Fort Cobb. The wells range from 150 to 300 feet in depth, and they produce from 200 to 600 gallons of water per minute.

[3] Bob G. Day, civil engineer, Soil Conservation Service, assisted in the preparation of this section.

Figure 8.—**Peanuts on a Pulaski fine sandy loam under sprinkler irrigation.**

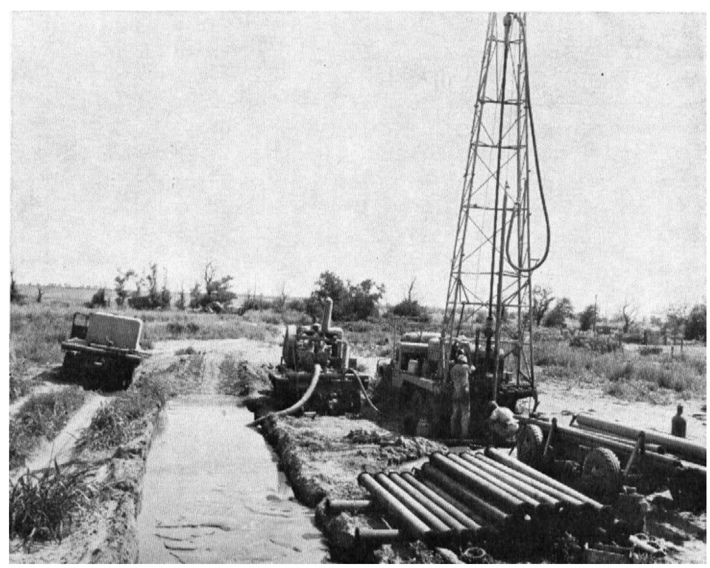

Figure 9.—**Drilling an irrigation well in a Pond Creek fine sandy loam.**

Some water for irrigation is pumped directly from the Washita River and from Cobb Creek. A few flood-control structures and farm ponds also provide water for irrigation. Another source of irrigation water is the Fort Cobb Reservoir built in 1960. This reservoir is designed to

store about 4,700 acre feet of water and provides irrigation water for about 6,000 acres.

Water is distributed on fields mainly by sprinkler systems, since most of the irrigated soils have a moderate to high intake rate. Also, in most areas the relief is rolling and land leveling is costly. On some soils of the bottom lands water is distributed on the surface by furrows or by borders. If sprinkler systems are used, labor costs can be reduced by such practices as using laterals on wheels that move mechanically, placing main lines underground, and using self-move systems.

In planning an irrigation system, the farmer needs to consider the availability, quality, and adequacy of the farm water supply. A well-designed system distributes the required amount of water to all parts of the area to be irrigated without soil damage or excessive loss of water. The system should be readily accessible and easy to operate without obstructing other farming operations. Other than the water supply, factors to be considered in planning an irrigation system are relief, features of the soils to be irrigated, existing facilities, and available financial and economic resources. The success of an irrigation system depends on the suitability of the soils that are irrigated. Soils that are irrigated should be capable of growing crops that will pay the cost of development of the system plus the costs of farming and of maintaining the irrigation system without damage to the soil.

Using water efficiently, distributing it uniformly, and protecting the soils from erosion, the main purposes of management, are influenced by the farmer's knowledge of conservation. A good understanding of the intake rate of the soil and a general idea of how water is held in the soil and released to plants is needed to help the farmer irrigate properly.

Farmers need technical help in planning for irrigation. Such help is available through the local office of the Soil Conservation Service and from other local representatives of the U.S. Department of Agriculture. Estimates of the cost of irrigating and information about equipment can be obtained from representatives of equipment dealers.

On the following pages, the capability units, or groups of soils similar in management requirements for irrigated farming, are described; some limitations are given; and suitable management is discussed. To find the names of all the soils in these capability units, refer to the "Guide to Mapping Units" at the back of this survey.

Capability unit I–1, irrigated

This unit consists of deep, well-drained, nearly level soils on terraces and uplands. These soils are loamy throughout.

The soils in this unit are suited to cotton, alfalfa, grain sorghum, and peanuts. Border, furrow (fig. 10), and sprinkler irrigation systems can be used to apply irrigation water. Suitable practices for conserving soil and water are keeping tillage to a minimum, returning all crop residues to the soil, and applying irrigation water properly.

Capability unit I–2, irrigated

In this unit are deep, nearly level, well-drained soils on uplands and terraces. These soils have a loamy surface layer. The layers below are loamy or clayey.

These soils are suited to alfalfa, cotton, and grain sorghum. They are suitable for border or furrow irrigation. The length of the rows can be extended because of the

Figure 10.—**Furrow irrigation system on Pond Creek silt loam, 0 to 1 percent slopes, in capability unit I–1, irrigated.**

fine-textured subsoil, and land leveling is not difficult on these nearly level soils. Sprinkler systems also can be used to apply irrigation water.

Suitable practices for conserving soil and water are keeping tillage to a minimum, using all crop residues, and applying irrigation water properly.

Capability unit IIe–1, irrigated

In this unit are deep and moderately deep, very gently sloping, well-drained soils on uplands. These soils are loamy throughout. Permeability is moderate to moderately slow.

These soils are suited to alfalfa, cotton, grain sorghum, and peanuts. Sprinkler irrigation is used on most of the soils. Border or furrow irrigation systems are suited, but considerable land leveling is needed.

Suitable practices for conserving soil and water are returning all crop residues to the soils, applying irrigation water properly, and keeping tillage to a minimum.

Capability unit IIe–2, irrigated

Noble fine sandy loam, 1 to 3 percent slopes, is the only soil in this unit. It is deep, very gently sloping, and well drained. This soil is on uplands. It is loamy throughout and has moderately rapid permeability.

This soil is suited to alfalfa, cotton, grain sorghum, peanuts, and tame pasture. It is better suited to sprinkler irrigation than to other kinds of irrigation systems. Suitable practices for conserving soil and water are returning all crop residues to the soil, applying irrigation water properly, and keeping tillage to a minimum.

Capability unit IIs–1, irrigated

Foard silt loam, 0 to 1 percent slopes, is the only soil in this unit. It is deep, nearly level, and moderately well drained. This soil is on uplands. The loamy surface layer is underlain by loamy or clayey material that is high in sodium.

This soil is suited to alfalfa, cotton, grain sorghum, and peanuts. Border or furrow irrigation systems are better than other systems for applying irrigation water on this

soil. Suitable practices for conserving soil and water are keeping tillage to a minimum, returning all crop residues to the soil, and applying irrigation water properly.

Capability unit IIw-1, irrigated

This unit consists of deep, nearly level, well-drained soils on flood plains. These soils have loamy and sandy surface layers underlain by loamy material. They are subject to flooding once in 1 to 5 years. The intake rate is moderate.

These soils are suited to alfalfa, cotton, grain sorghum, and peanuts. Sprinkler systems are better suited than other systems for applying irrigation water. Suitable practices for conserving soil and water are keeping tillage to a minimum, returning all crop residues to the soils, and applying irrigation water properly.

Capability unit IIw-2, irrigated

Port silt loam is the only soil in this unit. It is a deep, nearly level, well-drained soil. This soil is on flood plains and is subject to flooding once in 1 to 5 years. The intake rate is moderate.

This soil is suited to alfalfa, cotton, grain sorghum, and peanuts. Suitable practices for conserving soil and water are keeping tillage to a minimum, returning all crop residues to the soil, and applying irrigation water properly.

Capability unit IIIe-1, irrigated

This unit consists of deep and moderately deep, very gently sloping, well-drained soils on uplands. These soils are loamy throughout.

The soils in this unit are suited to cotton, peanuts, grain sorghum, and alfalfa. Sprinkler irrigation is the most suitable method to use for applying irrigation water.

Controlling water erosion is the chief concern of management on these soils. Suitable practices are keeping tillage to a minimum, returning all crop residues to the soil, and applying irrigation water properly.

Capability unit IIIe-2, irrigated

Dougherty loamy fine sand, 1 to 3 percent slopes, is the only soil in this unit. It is a deep, well-drained, very gently sloping soil on uplands. The sandy surface layer is underlain by loamy material.

This soil is suited to peanuts, cotton, grain sorghum, and alfalfa. Sprinkler systems are better suited than other systems for applying irrigation water. Suitable practices for conserving soil and water are keeping tillage to a minimum, returning all crop residues to the soil, and applying irrigation water properly. Growing cover crops in winter in fields used for row crops helps to provide protection from soil blowing. Delaying plowing as long as feasible in spring helps to protect the soil during the critical period of soil blowing.

Capability unit IIIe-3, irrigated

Tillman silty clay loam, 1 to 3 percent slopes, is the only soil in this unit. It is a deep, well-drained, very gently sloping soil on uplands. The loamy surface layer is underlain by clayey or loamy material.

This soil is suited to cotton, small grains, grain sorghum, and alfalfa. Border or furrow irrigation is better suited than other systems for applying irrigation water on this soil. Suitable practices for conserving soil and water are keeping tillage to a minimum, returning all crop residues to the soil, and applying irrigation water properly.

Capability unit IIIw-1, irrigated

Miller silty clay loam is the only soil in this unit. It is a deep, nearly level, moderately well drained soil that occurs on flood plains. The surface layer is loamy, and the material below is clayey or loamy. This soil is subject to flooding once in 5 to 20 years. Water stands in low spots and is likely to delay planting in spring.

This soil is suited to alfalfa, small grains, and cotton. Border or furrow irrigation systems are better suited for applying irrigation water than other systems.

Suitable practices for conserving soil and water are keeping tillage to a minimum, returning all crop residues to the soil, and applying irrigation water properly. Using such flood-control practices upstream as watershed protection projects, detention dams, and channel improvement help to reduce flooding.

Capability unit IVe-1, irrigated

This unit consists mainly of deep and moderately deep, gently sloping to sloping, well-drained soils on uplands. These soils have a loamy or sandy surface layer underlain by loamy material. The intake rate is moderate. Some areas of these soils are eroded.

These soils are suited to small grains, grain sorghum, cotton, and peanuts. The sprinkler system is the most feasible method for applying irrigation water. Suitable practices for conserving soil and water are keeping tillage to a minimum, returning all crop residues to the soil, and applying irrigation water properly. Growing a cover crop in winter in fields used for row crops helps to provide protection from soil blowing.

Capability unit IVe-2, irrigated

This unit consists of deep, well-drained, gently sloping to sloping soils on uplands. These soils are sandy or loamy. Their intake rate is high.

These soils are suited to alfalfa, grain sorghum, cotton, and peanuts. Sprinkler systems are better suited than other systems for applying irrigation water. Suitable practices for conserving soil and water are keeping tillage to a minimum, returning all crop residues to the soil, and applying irrigation water properly.

Capability unit IVe-3, irrigated

This unit consists of deep, very gently sloping to gently sloping, well-drained soils on uplands. These soils have a loamy surface layer and loamy and clayey underlying layers. Some of the soils in this unit are eroded.

Cotton and grain sorghum are the main crops. If the land is leveled and the system is properly designed, border and furrow irrigation are better suited than other irrigation systems. Suitable practices for conserving soil and water are keeping tillage to a minimum, returning all crop residues to the soil, and applying irrigation water properly.

Capability unit IVs-1, irrigated

Only Grant-Wing complex, 1 to 5 percent slopes, is in this unit. It consists of deep, very gently sloping to gently sloping soils that are well drained and somewhat poorly drained. These soils are on uplands. They are loamy throughout.

The soils in this unit are suited to cotton, grain sorghum, and alfalfa. Suitable practices for conserving soil and water are keeping tillage to a minimum, returning all crop residues to the soil, and applying irrigation water properly. Border, furrow, or sprinkler systems can be used, but poor soil characteristics make irrigation undesirable.

Adding gypsum is beneficial in places. If the soils are treated with gypsum, however, they should not be worked for at least two growing seasons.

Capability unit IVs–2, irrigated

In this unit are deep, very gently sloping or hummocky soils on uplands. These soils are sandy throughout.

The soils in this unit are suited to peanuts, cotton, and grain sorghum. Sprinkler irrigation systems are better for applying irrigation water than other irrigation systems.

Suitable practices for conserving soil and water are keeping tillage to a minimum, returning all crop residues to the soil, and applying irrigation water properly. These soils are sandy, and frequent irrigation is needed. Delaying plowing as long as feasible in spring helps to protect the soil during the critical period of soil blowing.

Predicted Yields of Crops (Dryland)

Table 2 gives predicted average yields of the principal dryland crops and of tame pasture grown on the soils of Caddo County. The yields in columns A are based on the prevailing, or most common management, and those in columns B are based on improved management. Predictions were not made for all those soils that are not normally suitable for cultivated crops. Crop failures, or years of no yield, are included in the yield averages.

The soil scientists who made this survey also obtained data on yields at specified levels of management when they talked with farmers and observed fields of crops. If sufficient data for a particular soil were not available, estimates were made by comparing the soil with similar soils for which data for several years were available. The yields are averages for a long period of time and include many wet and many dry years. In periods when rainfall is above average, the yields are considerably higher than those listed in table 2. The yields in the table can be used by farmers to determine the long-term average yields to be expected from each soil.

The yields in columns A are based on common management, or the management ordinarily used. Under this management suitable varieties of crops are grown and seeding is done at the proper time and rate. Methods of planting and harvesting are efficient, and weeds, insects, and plant diseases are controlled. Terraces and contour farming are used where needed, but little fertilizer is applied other than on cash crops and when planting legumes. Plowing is done mainly by using a moldboard plow.

The yields in columns B can be expected under improved management. Improved management includes all practices discussed under common management except the last one. Stubble mulching implements are used to help control erosion. In addition fertilizer is applied as indicated by soil tests; improved varieties of adapted crops are planted; cover crops are grown on soils susceptible to blowing; drainage is provided where needed; and crop residue and tillage are managed to prevent erosion, maintain soil structure, increase infiltration of water, and encourage the emergence of seedlings.

Specific practices for conserving soil and water are suggested for each soil in the subsection, "Management by Dryland Capability Units." Information about the use of fertilizer and lime can be obtained through the local office of the Soil Conservation Service and of the Extension Service.

Predicted Yields of Crops (Irrigated)

Table 3 gives predicted average acre yields of the principal crops grown on soils that are suited to irrigation in Caddo County. The yields given are those to be expected over a period of years and are for two levels of management. Predictions were not made for the soils that are not normally suited for cultivated crops. Crop failures, or years of no yield, are included in the yield averages.

In columns A are yields that can be expected under a low level of management. This management does not include use of definite cropping systems, the growing of soil-improving crops, applying fertilizer, or the efficient use of irrigation water.

In columns B are the yields that can be expected under a high level of management. This level of management includes land leveling, conserving irrigation water, proper tillage, use of crop residue, use of a cropping system that includes a soil-improving crop, and applying commercial fertilizer.

Specific practices for conserving soil and water are suggested for each soil in the subsection "Management by Irrigated Capability Units." Information about the use of fertilizer and lime can be obtained from the local office of the Soil Conservation Service and of the County Extension Director.

Range Management [4]

The raising of livestock is an important enterprise in Caddo County. Most of the livestock are cows and calves. In years when early pasture of small grains is good, however, a large number of stocker cattle are also kept. According to the Oklahoma Conservation Needs Inventory made in March 1970, about 318,206 acres, or 39 percent of the county, is in range. About 72 percent of the rangeland is upland prairie range sites, 27 percent is savannah range sites, and 1 percent is bottom-land range sites.

Because the deeper, less sloping soils are used for crops, the shallower, steeper, more erodible soils are left for range. Many fields that formerly were cultivated have been seeded to mixtures of native grass and are now used as range. The largest ranching area is in the southwestern part of the county, but rangeland is interspersed throughout the country.

In managing range, practices are needed that conserve soil and water and that encourage the growth of better native plants. Grazing practices that maintain or improve the condition of the range are needed on all range in the county. These practices include proper grazing use, deferred grazing, and rotation-deferred grazing.

[4] By FRED L. WHITTINGTON, range conservationist, Soil Conservation Service.

Livestock can be distributed better and more uniform grazing obtained by correctly locating fences; by developing facilities for watering livestock, such as ponds, wells, and springs; and by moving salt to areas where grazing is desired. The condition of the range can be improved on some sites by range seeding, by brush control, and by use of other methods that speed up improvement of the range.

Grazing needs to be adjusted from season to season so that enough cover is left to protect the soil and to maintain the quantity and quality of desirable plants. Repeated or prolonged overuse of range reduces the ability of the plants to produce the deep roots, seeds, and new shoots needed to maintain the stand.

The rancher needs to know the kinds of grasses growing on his range sites and if the range is improving or declining. Then he can manage grazing to encourage and increase the best native plants. Specific information about stocking range is not included in this survey. Technical personnel of local agricultural agencies can help the rancher to classify his range sites, to estimate the condition of the range, and to decide on the number of animals to stock.

Range sites and condition classes

Range sites are distinctive kinds of rangeland that have different potentials for producing native, or climax, plants. Unless the soils are severely disturbed physically, a range site retains its ability to reproduce the original plant community. The kind and amount of vegetation that originally grew on the site is constantly renewed. On the more productive rangeland, the present plant community is similar to the original one.

The soils in any one range site produce the same climax vegetation. *Climax vegetation* is the combination of plants that originally grew on the site. It is generally the most suitable and most productive vegetation for the site. Also, most plants in the climax vegetation are palatable and nutritious for grazing animals.

On the sites where grazing is intense, important changes in kinds and amounts of vegetation take place. Continuous excessive grazing alters the original plant cover and lowers productivity. The livestock seek out the more palatable and nutritious grasses, and under heavy grazing, these choice plants, or *decreasers*, are weakened and gradually eliminated. The choice plants are replaced by less palatable plants, or *increasers*. If heavy grazing continues, even these increasers are weakened and the site is eventually occupied by less desirable grasses and weeds, called *invaders*.

The downward trend in range vegetation generally is continuous under heavy grazing and can be expressed as range condition. Four classes of range condition are recognized. Range is in *excellent* condition if 76 to 100 percent of the plant cover consists of the original vegetation. It is in *good* condition if the percentage is 51 to 75; in *fair* condition if the percentage is 26 to 50; and in *poor* condition if the percentage is 25 or less. If range is in poor condition, most of the vegetation is made up of weak increasers and invaders.

Descriptions of the range sites

The soils of Caddo County have been grouped into range sites according to their ability to produce similar kinds and amounts of climax vegetation. The description of each range site gives the more important characteristics of the soils and the names of the principal plants. Also given is the estimated total annual yield of herbage on the site in excellent condition when moisture is favorable and when it is unfavorable. These estimates are based on the annual growth of plants. The soils in each range site can be determined by referring to the "Guide to Mapping Units" at the back of this survey.

LOAMY PRAIRIE RANGE SITE

This site consists of nearly level to steep soils on upland prairies. These soils have a loamy surface layer and loamy or sandy underlying material. A few of the soils are eroded.

The principal decreasers are sand bluestem, indiangrass, and switchgrass. The major increasers are side-oats grama and blue grama. If this site is in poor condition, the main invaders are silver bluestem, three-awn, and windmillgrass, and weeds are common.

Where this site is in excellent condition, the average annual yield of air-dry herbage is 4,500 pounds per acre in years of favorable moisture and 2,500 pounds acre in years of unfavorable moisture.

SHALLOW PRAIRIE RANGE SITE

This site consists of shallow, loamy, gently sloping to steep soils on uplands. These soils are underlain by sandstone, and in places sandstone crops out.

Under good management the dominant climax grasses are sand bluestem, little bluestem, indiangrass, and switchgrass. The main increasers are side-oats grama, blue grama, hairy grama, and purple three-awn. Common invaders are silver bluestem, hairy tridens, sand dropseed, puffsheath dropseed, skunkbush, and plum.

Where this site is in excellent condition, the average annual yield of air-dry herbage is 2,500 pounds per acre in years of favorable moisture and 1,300 pounds per acre in years of unfavorable moisture.

SANDY PRAIRIE RANGE SITE

This site consists of moderately deep and deep, nearly level to steep soils that are well drained. These soils are on uplands. They are loamy throughout. Part or most of the surface layer of some of these soils has been removed by erosion.

If this site is well managed and is in top condition, the principal decreaser grasses are sand bluestem, switchgrass, indiangrass, and little bluestem. The main increaser grasses are side-oats grama, blue grama, and buffalograss. Some of the common invaders are fall witchgrass, sand dropseed, and mat sandbur.

Where this site is in excellent condition, the average annual yield of air-dry herbage is 4,500 pounds per acre in years of favorable moisture and 2,000 pounds per acre in years of unfavorable moisture (fig. 11).

RED CLAY PRAIRIE RANGE SITE

This site consists of moderately deep, clayey, sloping to strongly sloping soils on uplands. These soils formed in red-bed clay and shale. They are well drained and are slowly permeable.

The main decreaser on this site is little bluestem, and the main increaser is side-oats grama. Annual three-awn, Japanese brome, little barley, and other weedy grasses

TABLE 2.—*Predicted average yields per acre of*

[Yields in columns A are those obtained under common management; yields in columns B are obtained under improved management. in the table generally are not used

Soil	Wheat		Oats		Grain sorghum	
	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Cobb fine sandy loam, 1 to 3 percent slopes	14	24	26	42	24	36
Cobb fine sandy loam, 3 to 5 percent slopes	12	20	20	36	21	31
Cobb fine sandy loam, 5 to 8 percent slopes	10	17	15	30	18	28
Cobb fine sandy loam, 3 to 8 percent slopes, eroded	9	14	14	28	17	27
Cyril fine sandy loam	14	26	32	48	26	40
Cyril fine sandy loam, noncalcareous variant	14	26	32	48	26	40
Darnell-Noble association, rolling						
Dougherty and Eufaula loamy fine sands, 3 to 8 percent slopes	10	16	12	20	16	25
Dougherty loamy fine sand, 1 to 3 percent slopes	12	18	14	24	22	33
Eufaula loamy fine sand, 1 to 3 percent slopes	10	16	12	22	18	29
Eufaula loamy fine sand, hummocky	8	12	10	18	15	21
Eufaula fine sand, rolling						
Foard silt loam, 0 to 1 percent slopes	15	22	28	42	21	32
Gracemont soils						
Grant loam, 1 to 3 percent slopes	20	30	31	51	30	40
Grant loam, 3 to 5 percent slopes	17	23	24	44	23	35
Grant loam, 3 to 6 percent slopes, eroded	12	18	22	35	20	31
Grant loam, 5 to 8 percent slopes	15	20	22	37	20	33
Grant-Wing complex, 1 to 5 percent slopes	9	16	15	32	17	25
Hollister silt loam, 0 to 1 percent slopes	17	28	30	50	23	36
Konawa loamy fine sand, 1 to 5 percent slopes, eroded	7	14	12	19	16	24
Konawa soils, 2 to 8 percent slopes, severely eroded						
McLain silty clay loam	24	34	40	60	40	50
Miller silty clay loam	16	22	30	50	29	39
Minco silt loam, 3 to 5 percent slopes	17	25	24	44	25	41
Minco very fine sandy loam, 3 to 8 percent slopes	15	23	22	37	20	33
Noble fine sandy loam, 1 to 3 percent slopes	16	23	26	40	24	36
Noble fine sandy loam, 3 to 8 percent slopes	12	18	16	30	20	32
Norge silt loam, 1 to 3 percent slopes	19	29	30	48	29	40
Norge silt loam, 3 to 5 percent slopes	17	24	24	44	23	38
Pond Creek silt loam, 0 to 1 percent slopes	21	33	33	55	32	45
Pond Creek silt loam, 1 to 3 percent slopes	19	30	31	50	30	41
Pond Creek silt loam, 1 to 3 percent slopes, eroded	15	22	20	35	22	33
Pond Creek fine sandy loam, 0 to 1 percent slopes	18	30	30	50	30	43
Pond Creek fine sandy loam, 1 to 3 percent slopes	17	28	28	45	28	38
Port silt loam	22	34	38	58	35	50
Port and Pulaski soils, channeled						
Pulaski soils	14	25	29	40	25	33
Quinlan-Woodward complex, 5 to 12 percent slopes						
Reinach silt loam, upland, 0 to 1 percent slopes	21	32	31	53	31	46
Reinach silt loam, 0 to 1 percent slopes	22	33	33	55	32	48
Reinach silt loam, upland, 1 to 3 percent slopes	20	30	30	50	30	44
Shellabarger fine sandy loam, 1 to 3 percent slopes	14	24	24	46	24	35
Shellabarger fine sandy loam, 3 to 5 percent slopes	12	20	21	38	21	30
Tillman silty clay loam, 1 to 3 percent slopes	15	22	27	46	18	28
Tillman silty clay loam, 3 to 5 percent slopes	12	19	20	35	17	25
Tillman silty clay loam, 2 to 5 percent slopes, eroded	10	16	16	30	16	21
Woodward-Quinlan complex, 3 to 5 percent slopes	12	18	21	32	19	32
Yahola soils	18	28	33	52	30	48

[1]Animal-unit-months is a term used to express the carrying capacity of pasture. It is the number of animal units, or 1,000 pounds of

principal dryland crops under two levels of management

Absence of yield indicates crop is not commonly grown on the soil at the level of management specified; soils and land types not listed for cultivated crops and pasture]

Peanuts		Cotton (lint)		Alfalfa		Tame pasture					
						Common bermudagrass		Improved bermudagrass		Weeping lovegrass	
A	B	A	B	A	B	A	B	A	B	A	B
Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Tons*	*Tons*	*Animal-unit-months* [1]	*Animal-unit-months* [1]	*Animal-unit-months* [1]	*Animal-unit-months* [1]	*Animal-unit-months* [1]	*Animal-unit-months* [1]
850	1, 500	225	375	1. 2	2. 2	3. 5	5. 5	4. 5	6. 2	4. 5	6. 0
700	1, 300	200	250			3. 0	4. 8	3. 5	5. 8	3. 5	5. 8
550	1, 000	125	240			2. 5	3. 8	3. 0	4. 8	2. 8	4. 8
500	900	120	230			2. 0	3. 2	2. 5	4. 0	2. 5	4. 0
1, 000	1, 300	280	450	2. 0	3. 0	4. 5	6. 5	6. 0	8. 0	6. 0	8. 0
1, 020	1, 345	280	450	2. 1	3. 1	4. 5	6. 5	6. 0	8. 0	6. 0	8. 0
										2. 0	3. 0
600	1, 250	125	240			2. 1	4. 0	2. 4	5. 0	2. 4	5. 0
800	1, 600	220	300			2. 8	4. 8	3. 2	5. 5	3. 0	5. 5
700	1, 400	120	230			2. 2	3. 0	2. 5	4. 0	2. 5	4. 0
600	1, 150	110	220			1. 8	2. 4	2. 0	3. 5	2. 4	3. 8
										1. 5	2. 0
		125	270	1. 0	1. 7						
						4. 5	6. 0	5. 5	7. 5		
700	1, 300	235	375	1. 5	2. 3	4. 0	5. 5	4. 8	6. 2	4. 5	6. 0
650	1, 200	220	300	1. 0	2. 0	2. 8	4. 8	3. 5	5. 5	3. 2	5. 2
						2. 0	3. 5	2. 8	4. 2	2. 5	4. 0
		175	250			2. 5	4. 0	3. 0	5. 0	2. 8	4. 6
		100	225			1. 8	3. 5	2. 5	4. 2	2. 5	4. 2
		200	325	1. 5	2. 4						
600	1, 150	125	240			2. 2	4. 4	2. 5	4. 8	2. 5	4. 8
										1. 8	2. 8
		350	550	2. 9	4. 0	4. 5	6. 5	6. 0	8. 0		
		225	400	1. 2	2. 8	3. 5	5. 0	4. 0	6. 5		
700	1, 300	225	310	1. 0	2. 0	3. 0	5. 0	4. 0	5. 8	3. 8	5. 6
600	1, 200	175	250			2. 8	4. 8	3. 2	5. 5	3. 2	5. 5
700	1, 300	200	310	1. 3	2. 2	3. 5	5. 5	4. 5	6. 2	4. 5	6. 0
550	1, 150	120	250			2. 5	4. 0	3. 0	5. 0	2. 8	4. 8
650	1, 250	230	350	1. 4	2. 2	3. 8	5. 6	4. 9	6. 7	4. 4	6. 4
650	1, 200	220	300	1. 0	2. 0	3. 0	5. 0	4. 0	5. 8	3. 8	5. 6
700	1, 350	250	400	2. 0	3. 0	4. 2	6. 0	5. 0	6. 8	4. 5	6. 2
650	1, 250	235	375	1. 5	2. 3	4. 0	5. 8	4. 8	6. 5	4. 2	6. 0
600	1, 100	100	220			2. 5	4. 0	3. 0	5. 5	2. 5	5. 0
1, 000	1, 750	250	400	1. 5	2. 5	4. 0	6. 2	5. 0	6. 8	4. 5	6. 5
900	1, 550	230	375	1. 3	2. 2	3. 8	5. 6	4. 5	6. 2	4. 5	6. 2
1, 000	1, 550	350	520	3. 0	4. 0	4. 5	6. 5	6. 0	8. 0	5. 8	7. 8
						4. 0	6. 0	5. 5	7. 5	5. 0	6. 5
900	1, 650	250	375	1. 5	2. 5	4. 2	6. 3	5. 8	7. 9	5. 8	7. 8
										2. 0	3. 0
700	1, 500	275	450	2. 2	3. 0	4. 5	6. 0	5. 2	7. 3	5. 0	7. 2
750	1, 600	350	550	3. 0	4. 0	4. 5	6. 5	6. 0	8. 0	6. 0	8. 0
650	1, 250	235	375	1. 5	2. 2	4. 0	5. 8	4. 8	6. 5	4. 5	6. 2
1, 000	1, 550	250	385	1. 3	2. 3	3. 8	5. 6	4. 6	6. 4	4. 5	6. 2
700	1, 300	200	260			3. 0	4. 8	3. 5	5. 8	3. 5	5. 8
		180	290	1. 2	2. 0						
		150	250								
		100	200								
		110	210							3. 0	4. 0
900	1, 600	250	380	2. 0	3. 0	4. 5	6. 5	6. 0	8. 0	5. 8	7. 8

live weight, that can be grazed on an acre of pasture for a period of 30 days.

TABLE 3.—*Predicted average acre yields of principal crops grown on irrigated soils under two levels of management*

[Yields in columns A are those obtained under a low level of management; yields in columns B are to be expected under a high level of management. Absence of yield indicates crop is not commonly grown on the soil at the level of management specified; soils and land types not listed in the table generally are not used for irrigated crops]

Soil	Peanuts		Cotton (lint)		Grain sorghum		Alfalfa	
	A	B	A	B	A	B	A	B
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Bu.*	*Bu.*	*Tons*	*Tons*
Cobb fine sandy loam, 1 to 3 percent slopes	2, 200	3, 200	600	800	60	100	3. 5	5. 5
Cobb fine sandy loam, 3 to 5 percent slopes	1, 900	2, 900	450	600	50	90	3. 0	4. 5
Cobb fine sandy loam, 5 to 8 percent slopes	1, 650	2, 650	300	500	40	75		
Cobb fine sandy loam, 3 to 8 percent slopes, eroded	1, 500	2, 500	250	450	40	70		
Cyril fine sandy loam	2, 100	3, 100	650	850	70	120	3. 5	5. 5
Cyril fine sandy loam, noncalcareous variant	2, 200	3, 200	650	850	70	120	4. 0	6. 0
Dougherty loamy fine sand, 1 to 3 percent slopes	2, 000	3, 000	500	750	60	100	3. 0	5. 0
Dougherty and Eufaula loamy fine sands, 3 to 8 percent slopes	1, 650	2, 650	300	500	40	75		
Eufaula loamy fine sand, 1 to 3 percent slopes	1, 800	2, 800	450	700	40	80		
Eufaula loamy fine sand, hummocky	1, 600	2, 600	300	550	30	70		
Foard silt loam, 0 to 1 percent slopes			350	700	60	100	3. 5	5. 5
Grant loam, 1 to 3 percent slopes	2, 100	3, 100	600	800	60	110	3. 5	5. 5
Grant loam, 3 to 5 percent slopes	1, 850	2, 850	450	600	50	90	3. 0	5. 0
Grant loam, 3 to 6 percent slopes, eroded	1, 500	2, 500	250	450	40	75		
Grant loam, 5 to 8 percent slopes	1, 600	2, 600	300	500	40	80		
Grant-Wing complex, 1 to 5 percent slopes			200	400	30	70	2. 0	3. 0
Hollister silt loam, 0 to 1 percent slopes			650	850	70	120	4. 0	6. 0
Konawa loamy fine sand, 1 to 5 percent slopes, eroded	1, 500	2, 500	450	650	35	75		
McLain silty clay loam			650	850	70	120	4. 0	6. 0
Miller silty clay loam			450	650	60	100	3. 5	5. 5
Minco silt loam, 3 to 5 percent slopes	1, 850	2, 850	550	700	45	85	3. 5	5. 0
Minco very fine sandy loam, 3 to 8 percent slopes	1, 650	2, 650	400	600	40	80		
Noble fine sandy loam, 1 to 3 percent slopes	2, 200	3, 200	550	750	65	110	3. 5	5. 5
Noble fine sandy loam, 3 to 8 percent slopes	1, 900	2, 900	300	500	40	80		
Norge silt loam, 1 to 3 percent slopes	2, 200	3, 200	650	800	65	110	3. 5	5. 5
Norge silt loam, 3 to 5 percent slopes	1, 400	2, 400	550	750	60	100	3. 0	5. 0
Pond Creek silt loam, 0 to 1 percent slopes	2, 300	3, 300	650	850	70	120	4. 0	6. 0
Pond Creek silt loam, 1 to 3 percent slopes	2, 200	3, 200	650	800	65	110	3. 5	5. 5
Pond Creek silt loam, 1 to 3 percent slopes, eroded	2, 100	3, 000	600	750	60	110	3. 0	5. 0
Pond Creek fine sandy loam, 0 to 1 percent slopes	2, 500	3, 500	650	850	70	120	4. 0	6. 0
Pond Creek fine sandy loam, 1 to 3 percent slopes	2, 300	3, 300	600	800	60	110	3. 5	5. 5
Port silt loam	2, 300	3, 300	650	850	70	120	4. 0	6. 0
Pulaski soils	2, 300	3, 300	600	800	65	110	3. 5	5. 5
Reinach silt loam, upland, 0 to 1 percent slopes	2, 400	3, 400	650	850	70	120	4. 0	6. 0
Reinach silt loam, upland, 1 to 3 percent slopes	2, 200	3, 200	600	800	65	110	3. 5	5. 5
Reinach silt loam, 0 to 1 percent slopes	2, 400	3, 400	650	850	70	120	4. 0	6. 0
Shellabarger fine sandy loam, 1 to 3 percent slopes	2, 200	3, 200	600	800	60	100	3. 5	5. 5
Shellabarger fine sandy loam, 3 to 5 percent slopes	1, 900	2, 900	450	600	50	90	3. 0	4. 5
Tillman silty clay loam, 1 to 3 percent slopes			550	750	60	100	3. 0	5. 0
Tillman silty clay loam, 3 to 5 percent slopes			450	650	45	80		
Tillman silty clay loam, 2 to 5 percent slopes, eroded			300	500	30	60		
Woodward-Quinlan complex, 3 to 5 percent slopes	1, 400	2, 400	250	450	30	60		
Yahola soils	2, 300	3, 300	600	800	65	110	3. 5	5. 5

and forbs are common invaders. Pricklypear and mesquite trees invade under continued heavy grazing.

Where this site is in excellent condition, the average annual yield of air-dry herbage is 2,400 pounds per acre in years of favorable moisture and 1,200 pounds per acre in years of unfavorable moisture.

GYP RANGE SITE

This site consists of gypsum bedrock and loamy soil material that is very shallow to gypsum. This is a very gently sloping to sloping upland land type.

The principal decreaser on this site is little bluestem. Important increaser grasses are side-oats grama, blue grama, and rough tridens. The percentage of forbs generally is high, and hairy goldaster is the principal forb.

Where this site is in excellent condition, the average annual yield of air-dry herbage is 1,800 pounds per acre in years of favorable moisture and 1,000 pounds per acre in years of unfavorable moisture.

SLICKSPOT RANGE SITE

This site consists of a deep, loamy, very gently sloping to gently sloping soil on uplands. Salt concentrates in layers beneath the surface of this soil and limits the vegetation to plants that tolerate salt.

The principal decreasers on this site are alkali sacaton,

Figure 11.—**An area of a Cobb fine sandy loam in the Sandy Prairie range site that has been burned over and now has an excessive amount of weeds and forbs.**

white tridens, and blue grama. Yellow neptunia is a common decreaser legume. Common increasers are whorled dropseed, purple lovegrass, and fall witchgrass. The principal invaders include rhombopod, curleycup gumweed, wax goldenweed, and pricklypear.

Where this site is in excellent condition, the average annual yield of air-dry herbage is 1,800 pounds per acre in years of favorable moisture and 800 pounds per acre in years of unfavorable moisture.

HARDLAND RANGE SITE

This site consists of deep, nearly level to gently sloping soils on uplands. These soils have a loamy surface layer and loamy or clayey underlying layers. They are very slowly permeable to slowly permeable. Erosion has removed part of the surface layer of some of the soils. In some soils concentrations of salt in the underlying layers limit the choice of vegetation.

The principal decreasers are side-oats grama, blue grama, and vine-mesquite. The most common increaser is buffalograss. Common invaders are rescuegrass, Japanese brome, and tumble windmillgrass. Pricklypear and mesquite are common invaders.

Where this site is in excellent condition, the average annual yield of air-dry herbage is 3,100 pounds per acre in years of favorable moisture and 1,500 pounds per acre in years of unfavorable moisture.

EDGEROCK RANGE SITE

This site consists of very shallow, loamy, sloping to steep soils on uplands. These soils are underlain by hard limestone that makes up 70 to 85 percent of the acreage. The Rock outcrop part of the site includes rows of exposed limestone turned on edge at an angle of about 45 degrees (fig. 12). The Rock outcrop makes up 15 to 30 percent of the site.

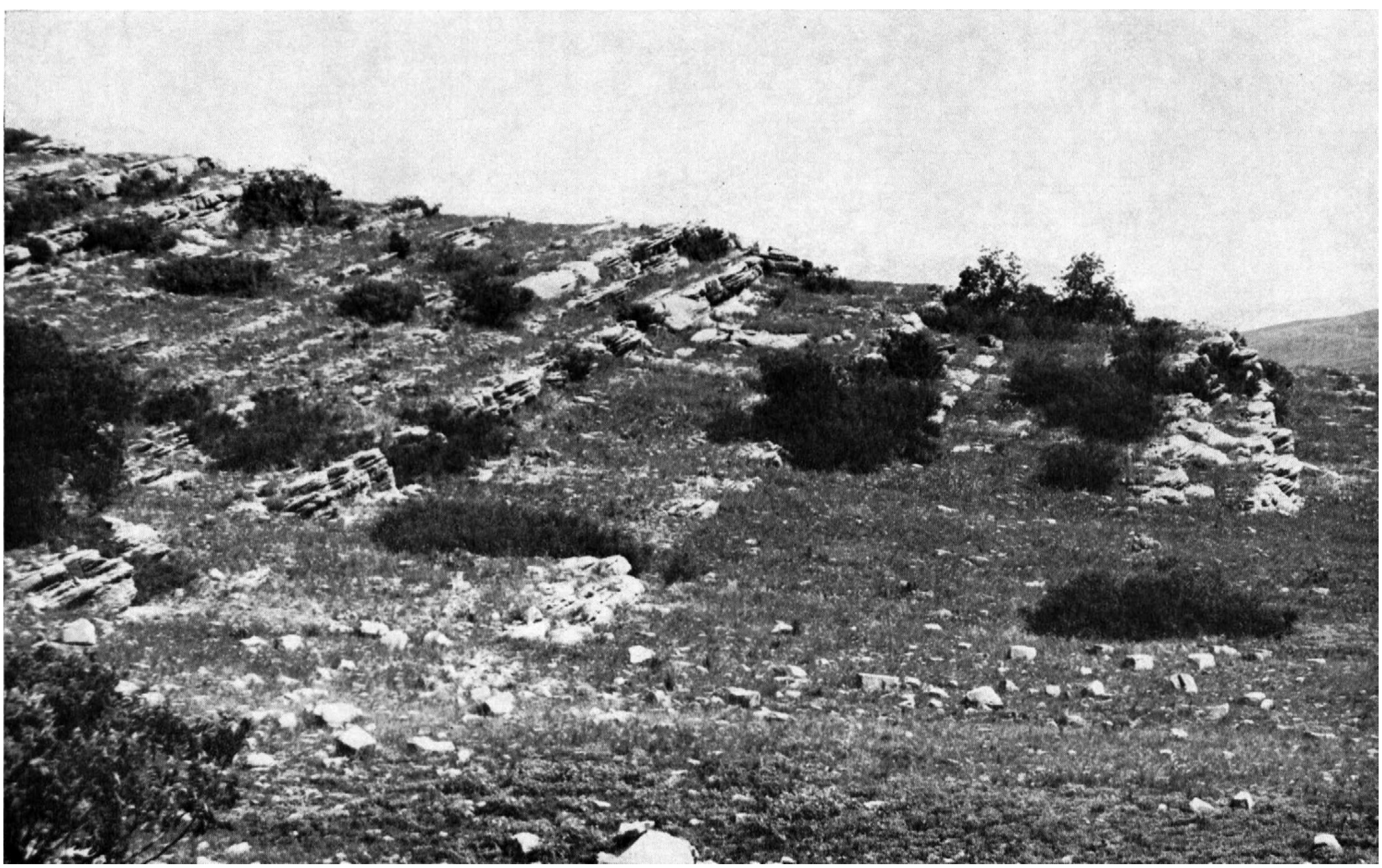

Figure 12.—**Rows of exposed tilted limestone in Edgerock range site. Talpa soils are between the outcrops of limestone.**

Important decreaser plants on this site are little bluestem and side-oats grama. Hairy grama and blue grama are the major increasers. Invaders are puffsheath dropseed, hairy tridens, and pricklypear. Hackberry and skunkbush increase in amount as the condition of the site deteriorates.

Where this site is in excellent condition, the average annual yield of air-dry herbage is 2,000 pounds per acre in years of favorable moisture and 1,000 pounds per acre in years of unfavorable moisture.

ERODED SHALLOW SAVANNAH RANGE SITE

This site consists of loamy, gently sloping to strongly sloping soils on uplands that are shallow to bedrock. These severely eroded soils are underlain by sandstone. All of the acreage was cultivated at some time. Most of the original surface layer of these soils has been washed away, and sandstone is exposed in many places.

About half the acreage of this site has been seeded to a mixture of native grasses. Common decreasers are little bluestem, sand bluestem, and indiangrass. The main increasers are side-oats grama and hairy grama. Common invaders are annual three-awn and mat sandbur.

When this site is in excellent condition, the average annual yield of air-dry herbage is 1,700 pounds per acre in years of favorable moisture and 1,000 pounds per acre in years of unfavorable moisture.

SHALLOW SAVANNAH RANGE SITE

This site consists of loamy, gently sloping to steep soils on uplands. These soils are shallow to sandstone.

The climax vegetation on this site consists of post oak and blackjack oak that have an understory of grasses, forbs, slender lespedeza, and other native legumes. Common decreasers are little bluestem, sand bluestem, and indiangrass. Side-oats grama, blue grama, and hairy grama are the principal increasers. Common invaders are crabgrass, mat sandbur, and annual three-awn.

Where this site is in excellent condition, the average annual yield of air-dry herbage is 2,800 pounds per acre in years of favorable moisture and 1,400 pounds per acre in years of unfavorable moisture.

SANDY SAVANNAH RANGE SITE

This site consists of deep, loamy, very gently sloping to steep soils on uplands. These soils are moderately permeable.

The climax vegetation on this site is dominantly tall and mid grasses that have an overstory that is not more than 10 percent woody plants (fig. 13). Sand bluestem, indiangrass, switchgrass, and little bluestem are the principal decreasers. The main increasers are side-oats grama, sand lovegrass, Texas bluegrass, and fringeleaf paspalum. Tumble windmillgrass, annual lovegrass, and mat sandbur are the main invaders.

Where this site is in excellent condition, the average annual yield of air-dry herbage is 4,400 pounds per acre in years of favorable moisture and 2,500 pounds per acre in years of unfavorable moisture.

***Figure 13.*—Sandy Savannah range site in excellent condition on a Noble fine sandy loam.**

DEEP SAND SAVANNAH RANGE SITE

This site consists of deep, sandy, very gently sloping to rolling soils on uplands. Most of the surface layer of some of the soils has been removed by erosion.

The climax vegetation on this site is mostly tall and mid grasses that have an overstory that is not more than 15 percent woody plants.

Principal decreasers are sand bluestem, indiangrass, Canada wildrye, switchgrass, and little bluestem. The main increasers are tall dropseed, purpletop, Scribner panicum, fringeleaf paspalum, silver bluestem, and sand dropseed. Invaders are fall witchgrass and mat sandbur. Controlling the woody plants improves the condition of the range (fig. 14).

***Figure 14.*—Deep Sand Savannah range site on Dougherty and Eufaula loamy fine sands, 3 to 8 percent slopes. The site is in excellent condition 2 years after aerial spraying of the woody vegetation.**

Where this site is in excellent condition, the average annual yield of air-dry herbage is 4,000 pounds per acre in years of favorable moisture and 1,750 pounds per acre in years of unfavorable moisture.

HEAVY BOTTOMLAND RANGE SITE

This site consists of a deep, loamy and clayey, nearly level soil on flood plains. This soil is subject to flooding. Permeability is very slow.

The main decreaser grasses on this site are switchgrass, western wheatgrass, tall dropseed, and vine-mesquite. Side-oats grama, blue grama, and buffalograss are the main increasers. Invaders are silver bluestem, tumble windmillgrass, and annual bromes.

Where this site is in excellent condition, the average annual yield of air-dry herbage is 5,000 pounds per acre in years of favorable moisture and 2,500 pounds per acre in years of unfavorable moisture.

LOAMY BOTTOMLAND RANGE SITE

This site consists of deep, loamy soils. Some of the soils are nearly level to gently sloping and are on flood plains. Others are gently sloping to steep and are in channels or are on breaks. Most of the soils in this site are subject to flooding.

The decreasers on this site are sand bluestem, switchgrass, indiangrass, and little bluestem. Principal increasers are western wheatgrass and side-oats grama. The main invaders are blue grama and buffalograss.

Where this site is in excellent condition, the average annual yield of air-dry herbage is 8,500 pounds per acre in years favorable moisture and 4,500 pounds per acre in years of unfavorable moisture.

SUBIRRIGATED RANGE SITE

This site consists of deep, loamy, nearly level soils on flood plains. These soils are subject to flooding, and they have a water table within a depth of 40 inches.

The dominant decreasers on this site are eastern gamagrass, prairie cordgrass, indiangrass, switchgrass, and sand bluestem. Increasers are little bluestem, side-oats grama, and western wheatgrass. Invaders are silver bluestem, buffalograss, blue grama, willow, elm, and cottonwood.

Where this site is in excellent condition, the average annual yield of air-dry herbage is 10,000 pounds per acre in years of favorable moisture and 5,000 pounds per acre in years of unfavorable moisture.

LIMESTONE RIDGES RANGE SITE

This site consists of a land type of loamy soil material, on ridges, that contains limestone cobblestones and is shallow to limestone conglomerate, limestone, or caliche (fig. 15).

Under good management the dominant plants are such short grasses as hairy grama, blue grama, and side-oats grama. Hairy tridens and purple three-awn are common increasers. Overgrazing or burning weakens the decreasers

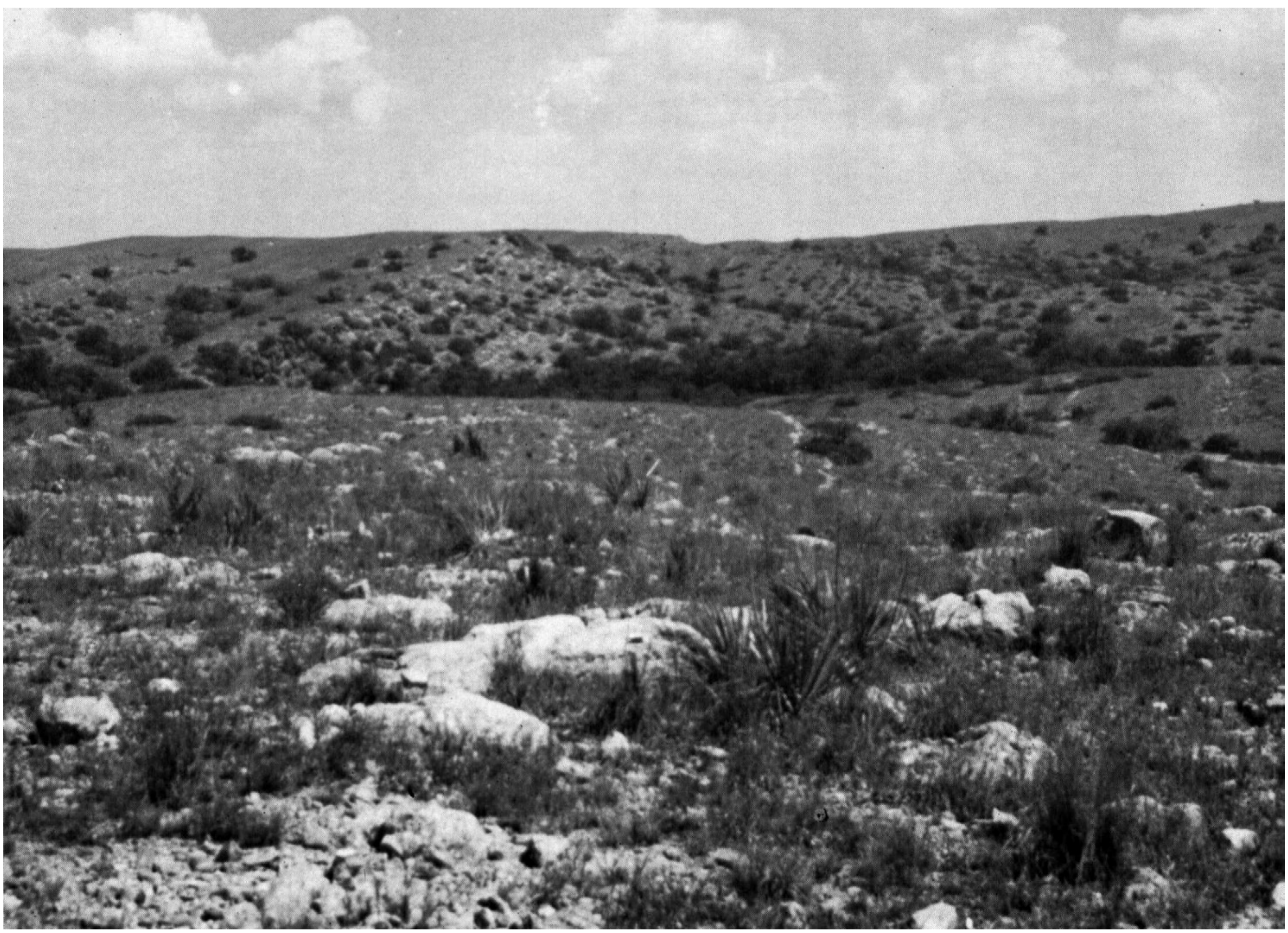

Figure 15.—**Limestone Ridges range site in fair condition.**

and increasers, and then plants from adjacent areas invade the site. Common invaders are pricklypear, annual three-awn, and tumblegrass.

Where this site is in excellent condition, the average annual yield of air-dry herbage is 2,300 pounds per acre in years of favorable moisture and 1,200 pounds per acre in years of unfavorable moisture.

BREAKS RANGE SITE

This site consists of a land type that occurs as canyon walls, rock escarpments, and as a mixture of soil material (fig. 16). In some of the canyons vegetation grows well, but steep slopes make these areas inaccessible to livestock.

Common decreasers on this site are little bluestem, sand bluestem, and tall dropseed. Side-oats grama and blue grama are the principal increasers. Common invaders are silver bluestem, hairy tridens, and sand dropseed. A few low-growing woody plants, such as skunkbush and plum, also grow on this site.

Where this site is in excellent condition, the average annual yield of air-dry herbage is 1,800 pounds per acre in years of favorable moisture and 1,000 pounds per acre in years of unfavorable moisture.

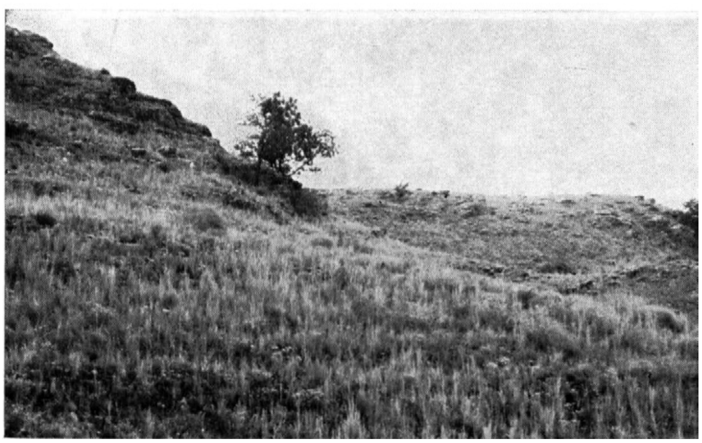

Figure 16.—**Breaks range site in excellent condition.**

Woodland [5]

Most of the woodland in Caddo County is on flood plains, mainly in the Port-Gracemont-Pulaski association. The original stands in the county have been cleared and the areas cultivated or pastured, or they are so severely overcut that they contain few trees of commercial value.

Many kinds of native trees grow in Red Rock Canyon Park, and most of them probably were present in the original stands. Among the trees growing in the park are bigtooth maple, sugar maple, red maple, western hackberry, slippery elm, American elm, chinquapin oak, bur oak, redbud, chittamwood, black walnut, western walnut, cottonwood, willow, and redcedar. The deep, undulating, sandy soils on uplands that border the rivers support stands or patches of blackjack and post oaks that have no commercial value. These trees also grow in some rough broken areas.

[5] By CHARLES C. BURKE, woodland conservationist, Soil Conservation Service.

The potential of the native trees in the county for commercial use is low. These trees have value, however, for wildlife and recreational uses and for esthetic purposes. In maintaining natural woodland and in planting trees for any purpose, the soils should be protected from erosion.

Windbreaks for protection of fields and farmsteads are important in the control of soil blowing. They also control drifting snow, provide shelter for livestock and wildlife, and protect farm buildings.

Windbreaks have not been planted to a large extent in Caddo County. Field windbreaks of two to four rows should be considered for some of the sandy soils. The rate of tree growth varies, depending on the soils and the kinds of trees and shrubs planted. Depth, texture, structure, and available water capacity are characteristics that affect growth and need consideration before planting a windbreak.

Farm windbreaks can be planted on soils less favorable to tree growth than those needed for field windbreaks. Extra care and special practices are justified, such as use of supplemental water from the farmstead supply or diverting water to the trees and extra cultivation. Otherwise, management of farmstead windbreaks is similar to that needed for field windbreaks.

Information on kinds of trees to plant, methods of planting, spacing in the rows and between the rows, and other factors in establishing and maintaining windbreaks can be obtained locally from the State Forestry Division, the Soil Conservation Service, and the Extension Service.

Growing trees for posts is feasible on some of the soils. Trees suitable for planting in post lots generally are not suitable for windbreak plantings. Black locust, catalpa, and Osage-orange are suitable trees for planting in post lots. Soils suitable for post lots are also well suited to farming. It may be desirable, however, for the farmer to use some soils that are good for farming in order to establish a satisfactory post lot.

In many places trees planted adjacent to gullies help to stabilize erodible soils and to protect the watershed. Trees planted in such critical areas require protection from fire and grazing. Other suitable practices are diverting water away from the heads of gullies and keeping a cover of plants on areas adjacent to the planted trees.

Trees planted in critical areas generally are spaced more closely than trees planted in post lots or in windbreaks. In many places planting within the gully is feasible and advantageous. The trees also beautify the landscape and provide habitat for wildlife.

Descriptions of woodland suitability groups

The soils in Caddo County have been placed in woodland suitability groups according to soil properties that affect the growth of trees. All the soils in a group have about the same capacity for supporting trees. Soils in group 1 are best suited for growing trees, and soils in group 4 are not suited for any type of tree under normal conditions. The soils in each woodland suitability group can be determined by referring to the "Guide to Mapping Units" at the back of this survey.

WOODLAND SUITABILITY GROUP 1

The soils in this group are deep and sandy or loamy. Some of the soils are nearly level to very gently sloping

and are on flood plains, terraces, and uplands. Others are sloping to steep and are on breaks and in channels.

These soils are suitable for planting trees in post lots, in field and farmstead windbreaks, and in areas that erode readily.

Trees suitable for post lots are black locust, catalpa, Osage-orange, and red mulberry. The trees can be harvested for posts when they are between 7 and 10 years old.

In windbreaks Siberian elm, honeylocust, cottonwood, white mulberry, and sycamore are suitable for the tall row. Suitable evergreens are shortleaf pine, Austrian pine, ponderosa pine, eastern redcedar, and Arizona cypress, and suitable shrubs are varieties of arborvitae, common lilac, sand plum, and Russian-olive.

WOODLAND SUITABILITY GROUP 2

The soils in this group are deep and moderately deep and sandy or loamy. These nearly level to sloping soils occur on uplands.

These soils are suitable for noncommercial woodland. During dry seasons establishing trees is likely to be difficult. If trees are planted on soils that have slopes of more than 5 percent, the rows are planted on the contour.

For post lots all of the soils in this group are suited to black locust, and the silt loams are also suited to Osage-orange. Both farmstead and field windbreaks can be established on these soils. Trees and shrubs suitable for windbreaks are Siberian elm, honeylocust, white mulberry, Austrian pine, ponderosa pine, eastern redcedar, Arizona cypress, arborvitae, common lilac, sand plum, and Russian-olive.

In areas that erode readily, black locust is the most suitable tree for planting.

WOODLAND SUITABILITY GROUP 3

This group consists of deep to shallow, sandy or loamy, nearly level to very steep soils. These soils are on uplands and flood plains. Some of the soils have severe limitations for trees because of their high content of sodium, shallow depth, steep slopes, or erodibility. The soils on flood plains have a water table at a depth of less than 40 inches.

The soils in this group are not suitable for field windbreaks or post lots. On slopes of more than 5 percent, tree rows must be on the contour. Farmstead windbreaks can be established, but extra care and maintenance are required. The vigor of the trees declines at an age between 20 and 25 years. The maximum height the trees attain ranges from 20 to 30 feet.

Suitable trees for farmstead windbreaks are Siberian elm, honeylocust, and Russian mulberry. Eastern redcedar and ponderosa pine are suitable evergreens, and arborvitae, sand plum, and Russian-olive are suitable shrubs.

WOODLAND SUITABILITY GROUP 4

This group consists of soils that vary greatly in characteristics. These soils are deep to very shallow and nearly level to very steep. The areas range from flood plains to uplands. Some of the soils are not eroded, and the soils that are eroded range to severely eroded.

These soils are not suited to trees, and they do not support any kind of tree that is useful or has commercial value.

Wildlife [6]

The important kinds of wildlife in Caddo County are bobwhite quail, mourning dove, fox squirrel, cottontail rabbit, jackrabbit, deer, turkey, raccoon, opossum, skunk, muskrat, and beaver. The predators are coyote, fox, and bobcat. Among the predatory birds are many species of hawks and owls. Many kinds of songbirds live in the county. Releases of such exotic birds as redleg partridge, black-necked pheasant, and chukar partridge have been made on a trial basis. Waterfowl use the ponds and lakes of the county during migration seasons. About 3,360 farm ponds are in the county (fig. 17), and most of them are suitable for production of fish.

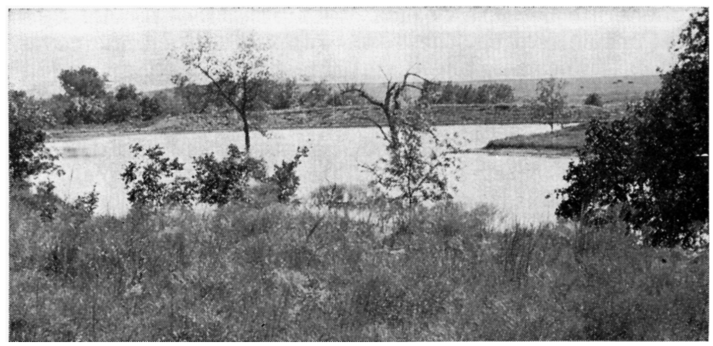

Figure 17.—A farm pond in the Breaks mapping unit furnishes water, food, and shelter for wildlife. (*Courtesy of Bureau of Indian Affairs, U.S. Dept. Int.*)

Wildlife in the county appears to be related to the soil associations and to the land use. The soil associations are described in the section "General Soil Map," and their location is shown on the general soil map at the back of this survey. Suitability of the soils for wildlife in relation to the soil associations is given in the pages that follow.

The soils in the Port-Gracemont-Pulaski association are suitable for supplemental plantings to improve habitat for all species of wildlife in the county. In areas not cultivated, wildlife lives in such hardwoods as pecan, walnut, bur oak, elm, soapberry, hackberry, and cottonwood, and in such shrubs as sumac, plum, and greenbrier. The hazard of flooding limits the use of these soils for some kinds of wildlife, particularly birds that nest on the ground. Constructing farm ponds for production of fish is not feasible on these soils because of lack of suitable sites.

The soils in the Pond Creek-Minco association are suitable for production of supplemental wildlife habitat. The wooded ravines in this association make these soils a favorable habitat for turkey, quail, deer, and squirrel. Where sites are suitable, farm ponds for production of fish can be constructed.

The soils in the Pond Creek-Cobb association have low to moderate suitability for wildlife habitat. These soils have moderate suitability for supplemental wildlife plantings. In areas of woody cover near cultivated fields, suitability for quail is moderate to high. Suitable sites for constructing fishponds are in this association.

[6] By JEROME F. SYKORA, biologist, Soil Conservation Service.

The suitability of the soils in the Grant-Pond Creek-Lucien association for most kinds of wildlife is low. These soils, however, are suited to doves because of the abundance of waste grain and weed seeds. Woody vegetation for nests is limited. Except for the shallow soils, all of the soils in this association are suitable for constructing fishponds, but suitable sites are limited. In areas not cultivated, these soils support a grass cover. Limited areas of woody cover are along streams and drainageways, but the soils are not suitable for production of woody cover for wildlife habitat.

The soils in the Dougherty-Eufaula association are suitable for supplemental planting for wildlife habitat. These soils are well suited to quail, deer, turkey, cottontail rabbit, and doves. Their suitability for squirrel is low to moderate because of lack of suitable trees for dens. In areas not cultivated, these soils support a woodland cover of oak, skunkbush, plum, and sumac that have an understory of tall grasses. No suitable sites for constructing fishponds are available in these soils.

Soils of the Noble-Darnell association are suitable for all important species of wildlife. Supplemental planting for wildlife habitat is suitable in selected areas. The suitability for wildlife increases in areas where some fields are cultivated. Additional habitat is provided where small areas of timber are cleared. Some soils in this association are suitable for constructing fishponds. Oak, elm, cottonwood, walnut, sumac, and plum are the major trees on these soils, and the understory consists of tall native grasses.

Suitability for wildlife for soils of the Talpa-Rock outcrop association is low, but deer, jackrabbit, and doves make some use of the areas. These soils are shallow to bedrock and are not suitable for supplemental plantings for wildlife. The Rock outcrop part of the association has low suitability for wildlife. Pond sites for production of fish are suitable in some places.

The soils of the Tillman-Hollister-Foard association have low suitability for production of wildlife. Suitability for doves is moderate to high. These soils are not suited to woody vegetation in sufficient kinds and amounts to be of value to wildlife. Pond sites are few, and high turbidity reduces production of fish.

Engineering Uses of the Soils [7]

This section provides information of special interest to engineers, as well as to contractors, farmers, and others who use soil as structural material or as foundation material upon which structures are built. The soil properties most important to the engineer are those that affect the construction and maintenance of roads and airports, pipelines, the foundations of buildings, facilities for storing water, structures for controlling erosion, drainage systems, and systems for disposing of sewage. Among the properties most important to the engineer are permeability to water, shear strength, compaction characteristics, soil drainage, shrink-swell potential, available water capacity, grain size, plasticity, and reaction. Also important are depth to the water table, the flooding hazard, depth to bedrock or to sand and gravel, and relief. Such information is made available in this section. Engineers can use it to—

[7] By Bob G. Day, civil engineer, Soil Conservation Service.

1. Make soil and land use studies that will aid in selecting and developing sites for industries, businesses, residences, and recreational areas.
2. Make estimates of the engineering properties of soils for use in the planning of agricultural drainage systems, farm ponds, irrigation systems, terraces and diversions, waterways, and other structures for conserving soil and water.
3. Make preliminary evaluations of soil and ground conditions that will help in selecting locations for highways, airports, pipelines, and cables and in planning detailed investigations at the selected locations.
4. Locate probable sources of sand, gravel, and other materials for use in construction.
5. Correlate performance of engineering structures with soil mapping units to develop information for planning that will be useful in designing and maintaining the structures.
6. Determine the suitability of the soils for cross-country movement of vehicles and construction equipment.
7. Supplement information obtained from other published maps, reports, and aerial photographs for the purpose of making maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

Used with the soil map to identify the soils, the engineering interpretations in this subsection can be useful for many purposes. It should be emphasized, however, that the interpretations may not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads or where the excavations are deeper than the depths of layers here reported. Nevertheless, even in such situations, the tables and the soil map are useful for planning more detailed fieldwork and suggesting the kind of problems that can be expected.

Information of value in planning engineering work is given throughout the text, particularly in the sections "Descriptions of the Soils" and "Formation and Classification of Soils."

Some of the terms used by the soil scientist may not be familiar to engineers, and some words—for example clay, silt, and sand—may have a special meaning in soil science. These and other terms used in the soil survey are defined in the Glossary at the back of the survey, and some of them are explained in detail in the "Soil Survey Manual" (*5*). Much of the information in this section is given in tables 4, 5, and 6.

Engineering classification systems

Soil scientists of the U.S. Department of Agriculture classify soils according to texture. In some ways this system of naming textural classes is comparable to the systems most commonly used by engineers for classifying soils. These are the systems used by the American Association of State Highway Officials (AASHO) (*1*), and the Unified system (*7*). Both classifications are used in this survey.

Most highway engineers classify soils according to the AASHO system. In this system, soil materials are classified in seven principal groups. The groups range from A–1 through A–7. In group A–1 are gravelly soils of high

bearing capacity. In group A–7 are clayey soils that have low strength when wet and are the poorest soils for subgrade. Such highly organic soils as peat and muck are not included in the AASHO classification because their use as construction material or foundation material should be avoided. For each of the principal groups, the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best material to 20 for the poorest. For the soils tested, the group index numbers are shown in table 6, in parentheses following the soil group symbol. The estimated AASHO classification of the soils in the county, without a group index number, is given in table 4.

In the Unified classification system the soils are classified according to their texture and plasticity and their performance as engineering construction materials. Soil material is divided into 15 classes. Eight classes (GW, GP, GM, GC, SW, SP, SM, and SC) are for coarse-grained material; six classes (ML, CL, OL, MH, CH, and OH) are for fine-grained material; and one class (Pt) is for highly organic material. The clean sands are identified by the symbols SW and SP; sands mixed with fines of silt and clay are identified by the symbols SM and SC; silts and clays that have low liquid limit are identified by the symbols ML and CL; and silts and clays that have a high liquid limit are identified by the symbols MH and OH. The tested soils are classified according to the Unified system in table 6, and the classification for the soils that were not tested is estimated in table 4.

Estimated engineering properties

Table 4 provides estimates of some properties of soils that affect engineering. The estimates are for a representative profile or for a profile typical of the soil series. For the soils in the county that were tested, estimates in table 4 are based on the test data given in table 6. For the other soils, estimates are based on test data obtained from similar soils in this county and in other counties, and on past experience in engineering. Because the estimates are for representative profiles, variations from the estimates may be considerable. Depth to the water table is not given in this table, because the water table is at a great depth and is not significant to engineering.

Permeability, as used in table 4, refers to movement of water downward through undisturbed and uncompacted soil. It does not include lateral seepage. The estimates are based on the structure and porosity of the soil. Crusting of the surface, presence of a plowpan and other factors resulting from use of the soils are not considered in the estimates.

Available water capacity, given in inches per inch of soil depth, is the capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point.

Reaction as shown in the table is the estimated range in pH value for each major horizon as determined in the field. It indicates the degree of acidity or alkalinity of a soil. A pH of 7, for example, indicates a neutral soil, a lower pH value indicates acidity, and a higher value indicates alkalinity.

Shrink-swell potential refers to the changes in volume of soil that results from a change in moisture content. Estimates are based on tests for volume change or on observations of other physical properties of the soils. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A shrink-swell potential of *high* indicates that maintaining structures built on the soil will be difficult.

The estimates of corrosion rates in table 4 are for the horizon in which uncoated steel pipes or concrete pipes are likely to be buried. Such materials may corrode when buried in soil, and a given material corrodes in some kinds of soil more rapidly than in others. If installation is extensive and the pipeline intersects soil boundaries or soil horizons, the conduits are more likely to be damaged by corrosion than if the conduits are laid entirely in one kind of soil or soil horizon.

In general, the estimates are based on soil texture, on the amount and type of clay in the soil, the total acidity, the amount and kind of soluble salts present, the moisture content of the soil, and the kind of conduit material. Generally, soils that have poor aeration, a high pH value, and are high in electrical conductivity and in content of salt have a high corrosion potential for metal conduits. On the other hand, soils that have a low pH value have a high corrosion potential for concrete conduits. All soils are more corrosive when they are wet.

Engineering interpretations

Table 5 rates the soils according to their suitability as a source of topsoil, sand and gravel, and road fill. It also lists specific features that affect use of the soils as sites for highways, for agricultural engineering, for buildings, and for sewage disposal systems. Then the hydrologic soil group is given. The information in this table is based on the estimated engineering properties of the soils in table 4, on the actual test data in table 6, and on experience with the soils in the field. The information applies only to the soil depth indicated in table 4, but it is reasonably reliable to a depth of about 6 feet for most soils, and to a depth of several more feet for some. Suitability ratings as a source of material for various uses are given in the table, as well as undesirable features and desirable features.

Topsoil refers to soil material preferably rich in organic matter, used as a topdressing for roadbanks, lawns, gardens, and other areas where a good seedbed is needed for establishment of vegetation. The suitability of a soil as a source of topsoil depends largely on texture and stability of the material, content of organic matter and stones, depth of the soil, and ease of excavation.

Ratings of the suitability of the soils as a source of sand and gravel are based on the probability that the areas contain deposits of sand and gravel. The ratings do not indicate quality or size of the deposits.

Road fill is material used to build embankments. It can be of almost any kind of soil material. The ratings indicate the performance of different kinds of soil material moved from borrow areas for use as road fill.

The location of a highway is influenced by depth to bedrock or other limiting material and by local drainage. Stability of the soil also is important.

Among the soil features that affect the suitability of the soils for reservoirs and embankments for farm ponds are depth to bedrock and the water table, permeability, the presence of stones, strength and stability of the soil material, shrink-swell potential, and the content of organic matter.

The factors considered for farm drainage are those features and qualities of the soil that affect the installa-

TABLE 4.—*Estimated engineering*

[Not included in this table, because their characteristics are too variable to be classified, are the land types Breaks (Bk), Gypsum outcrop

Soil series and map symbol	Depth to bedrock	Depth from surface of typical profile	Classification		
			USDA texture	Unified	AASHO
	Inches	*Inches*			
Acme (AgD)	10–20	0–15	Silt loam	ML–CL	A–4
(Gypsum outcrop part not rated.)		15	Gypsum.		
Cobb (CoB, CoC, CoD, CoD2, CrD3)	20–48	0–8	Fine sandy loam	SM	A–2
(For properties of Grant soil in mapping unit CrD3, refer to the Grant series in this table.)		8–41	Sandy clay loam	SC, CL	A–4, A–6
		41–66	Sandstone.		
Cyril (Cs, Cy)	120+	0–12	Fine sandy loam	SM	A–4
		12–60	Loam	ML	A–4
Darnell (DaD3, DnD, DnE)	4–20	0–14	Fine sandy loam	SM	A–4
(For properties of Noble soil in mapping units DnD and DnE, refer to the Noble series in this table.)		14	Sandstone.		
Dill	20–48	0–30	Fine sandy loam	SM	A–4
(Mapped only in complexes with Lucien soils.)		30	Sandstone.		
Dougherty (DoB, DuD)	120+	0–27	Loamy fine sand	SM	A–2
(For properties of Eufaula soil in mapping unit DuD, refer to the Eufaula series in this table.)		27–39	Sandy clay loam	SC, CL	A–4, A–6
		39–61	Fine sandy loam	SM	A–2
		61–72	Loamy fine sand	SM	A–2
Eufaula (EfD, EuB, EuC)	120+	0–72	Fine sand	SP, SM	A–2
Foard (FoA)	60–120+	0–8	Silt loam	ML or CL	A–4
		8–52	Clay	MH or CH	A–7
		52–72	Silty clay loam	CL	A–7
Gracemont (Gm)	120+	0–46	Fine sandy loam	SM	A–4
		46–54	Loam	ML or CL	A–4
Grant (GrB, GrC, GrC2, GrD, GwC)	40+	0–20	Loam	ML or CL	A–4
(For properties of Wing soil in mapping unit GwC, refer to the Wing series in this table.)		20–36	Silt loam	CL	A–6
		36–66	Loam	ML or CL	A–4
Hollister (HoA)	60–120	0–14	Silt loam and silty clay loam.	ML–CL	A–4, A–7
		14–72	Clay	CH	A–7
Konawa (KoC2, KsD3)	120+	0–6	Loamy fine sand	SM	A–2
		6–38	Sandy clay loam	SC or CL	A–4, A–6
		38–60	Loamy fine sand	SM	A–2
Lucien (LuD, LuE)	7–20	0–17	Fine sandy loam	SM or ML	A–4
(For properties of Dill soil in these mapping units, refer to the Dill series in this table.)		17	Sandstone.		
McLain (Mc)	120+	0–14	Silty clay loam	ML–CL	A–6
		14–28	Clay	CL	A–7
		28–60	Silty clay loam	ML–CL	A–6 to A–7
Miller (Me)	120+	0–8	Silty clay loam	CL	A–6
		8–73	Clay	CH	A–7
Minco (MoD, MoE, MsC)	120+	0–72	Silt loam	ML	A–4
Noble (NoB, NoD)	48+	0–72	Fine sandy loam	SM or ML	A–4

properties of soils

part of mapping unit AgD, Limestone cobbly land (Lm), Rock outcrop part of mapping unit TaE, and Rough broken land (Ro). < = less than]

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)					Uncoated steel	Concrete
				Inches per hour	*Inches per inch of soil*	*pH value*			
100	90–100	90–100	75–90	0. 63–2. 0	0. 14	7. 4–8. 4	Low	High	Moderate.
100	90–100	60–80	20–35	0. 63–2. 0	. 12	6. 1–7. 3	Low	Low	Low.
100	100	90–100	40–60	0. 63–2. 0	. 14	6. 1–7. 3	Low	Moderate	Low.
100	90–100	70–85	36–50	0. 63–2. 0	. 12	7. 9–8. 4	Low	Low	Low.
100	90–100	80–95	55–85	0. 63–2. 0	. 14	7. 9–8. 4	Low	Low	Low.
100	90–100	70–85	36–50	2. 0–6. 3	. 12	5. 6–7. 3	Low	Low	Low or moderate.
100	90–100	65–85	36–50	2. 0–6. 3	. 12	6. 1–7. 8	Low	Low	Low.
100	90–100	70–100	10–30	2. 0–6. 3	. 07	5. 6–6. 5	Low	Low	Moderate or low.
100	100	90–100	40–60	0. 63–2. 0	. 14	5. 1–6. 0	Low	Moderate	Moderate.
100	90–100	75–100	20–35	0. 63–2. 0	. 12	5. 6–6. 0	Low	Low	Moderate.
100	90–100	70–100	10–30	2. 0–6. 3	. 07	5. 6–6. 0	Low	Low	Moderate.
100	90–100	60–85	10–30	6. 3–20. 0	. 05	5. 1–7. 3	Low	Low to very low.	Low to high.
100	100	90–100	80–95	0. 2–0. 63	. 14	6. 1–7. 3	Low to moderate.	Moderate	Low.
100	100	90–100	85–100	<0. 06	. 17	7. 4–8. 4	High	High	Low.
100	100	90–100	85–95	0. 2–0. 63	. 14	7. 4–8. 4	Moderate	High	Low.
100	90–100	70–85	40–50	2. 0–6. 3	. 12	7. 8–8. 4	Low	Moderate	Low.
100	100	85–95	60–75	----------	. 14	7. 4–7. 8	Low	Moderate	Low.
100	100	85–100	70–85	0. 63–2. 0	. 14	6. 6–7. 8	Low	Low	Low.
100	100	85–100	80–90	0. 63–2. 0	. 14	6. 6–8. 4	Low to moderate.	Low	Low.
100	100	85–100	70–85	0. 63–2. 0	. 14	6. 6–8. 4	Low	Low	Low.
100	100	100	75–90	0. 63–2. 0	. 14	7. 4–7. 8	Low to moderate.	Low	Low.
100	100	90–100	90–100	0. 06–0. 2	. 17	7. 8–8. 4	High	High	Low.
100	90–100	60–85	15–30	2. 0–6. 3	. 07	5. 6–6. 5	Low	Low	Moderate.
100	100	90–100	40–60	0. 63–2. 0	. 14	5. 6–6. 5	Low	Moderate	Moderate to low.
100	90–100	60–85	15–30	2. 0–6. 3	. 07	6. 1–7. 3	Low	Low	Low or moderate.
100	90–100	70–85	40–55	2. 0–6. 3	. 12	5. 6–7. 3	Low	Low	Low or moderate.
100	100	90–100	85–95	0. 2–0. 63	. 17	6. 6–7. 8	Moderate	Moderate	Low.
100	100	90–100	90–95	0. 2–0. 63	. 17	6. 6–7. 8	High	High	Low.
100	100	90–100	85–95	0. 2–0. 63	. 17	6. 6–7. 8	Moderate	Moderate	Low.
100	100	95–100	85–95	0. 06–0. 2	. 17	7. 4–8. 4	Moderate to high.	High	Low.
100	100	95–100	90–100	<0. 06	. 17	7. 9–8. 4	High	High	Low.
100	100	90–100	55–90	0. 63–2. 0	. 14	6. 1–8. 4	Low	Low	Low.
100	90–100	90–100	40–55	2. 0–6. 3	. 12	6. 1–7. 3	Low	Low	Low.

TABLE 4.—*Estimated engineering*

Soil series and map symbol	Depth to bedrock	Depth from surface of typical profile	Classification: USDA texture	Classification: Unified	Classification: AASHO
	Inches	*Inches*			
Norge (NrB, NrC)	60+	0–8	Silt loam	ML–CL	A–4
		8–74	Silty clay loam	CL	A–6, A–7
Pond Creek:					
Fine sandy loam (PcA, PcB)	60+	0–9	Fine sandy loam	SM or ML	A–4
		9–86	Loam	ML or CL	A–4
Silt loam (PkA, PkB, PkB2)	60+	0–20	Silt loam	ML or CL	A–4
		20–50	Silty clay loam	CL	A–6, A–7
		50–60	Loam	ML or CL	A–4, A–6
		60–66	Fine sandy loam	SM or ML	A–4
Port (Po, Pp) (For properties of the Pulaski soil in mapping unit Pp, refer to the Pulaski series in this table.)	120+	0–57	Silt loam	ML or CL	A–4
		57–75	Loam	ML	A–4
Pulaski (Pu)	120+	0–72	Fine sandy loam	SM	A–4
Quinlan (QwD) (For properties of Woodward soil in mapping unit QwD, refer to the Woodward series in this table.)	10–20	0–14	Silt loam	ML	A–4
		14–55	Silty sandstone.		
Reinach (ReA, ReB, RhA)	120+	0–32	Silt loam	ML–CL	A–4
		32–62	Loam	ML–CL	A–4
		62–72	Very fine sandy loam	ML	A–4
Shellabarger (ShB, ShC)	60+	0–9	Fine sandy loam	SM	A–2
		9–27	Sandy clay loam	SC–CL	A–4, A–6
		27–76	Fine sandy loam	SM	A–2
		76–100	Clay loam	ML–CL	A–4, A–6
Talpa (TaE) (Rock outcrop part not rated.)	6–10	0–8	Silt loam	ML–CL	A–4
		8	Hard limestone.		
Tillman (TlB, TlC, TlC2)	60+	0–12	Silty clay loam	ML–CL	A–6
		12–60	Silty clay	CL	A–7
Vernon (VeD)	24+	0–48	Clay	CH	A–7
Wing (Mapped only in a complex with Grant soils.)	42+	0–6	Fine sandy loam	SM	A–4
		6–37	Clay loam	CL	A–6
		37–80	Loam	ML–CL	A–4
Woodward (WuC) (For properties of Quinlan soil in this mapping unit, refer to the Quinlan series in this table.)	24–48	0–24	Silt loam	ML–CL	A–4
		24–48	Consolidated siltstone and sandstone.		
Yahola (Ya)	120+	0–60	Fine sandy loam	SM	A–4
		60–64	Clay loam	CL–ML	A–4, A–6
		64–72	Fine and medium sand	SM–SP	A–3

properties of soils—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)					Uncoated steel	Concrete
				Inches per hour	*Inches per inch of soil*	*pH value*			
100	100	90–100	75–90	0. 63–2. 0	0. 14	6. 1–7. 3	Low	Low	Low.
100	100	90–100	85–95	0. 2–0. 63	. 17	6. 1–7. 3	Moderate	Moderate	Low.
100	100	70–85	40–55	0. 63–2. 0	. 12	5. 6–7. 3	Low	Low	Moderate or low.
100	100	90–100	55–85	0. 63–2. 0	. 14	6. 1–7. 8	Low	Low	Low.
100	100	90–100	75–90	0. 63–2. 0	. 14	5. 6–7. 3	Low	Low	Moderate or low.
100	100	90–100	85–95	0. 2–0. 63	. 17	6. 1–7. 3	Moderate	Moderate	Low.
100	100	90–100	55–85	0. 63–2. 0	. 14	6. 1–7. 3	Low	Low	Low.
100	90–100	70–85	40–55	0. 63–2. 0	. 12	6. 6–7. 3	Low	Low	Low.
100	100	90–100	80–95	0. 63–2. 0	. 14	6. 6–7. 8	Low	Low	Low.
100	100	90–100	60–85	0. 63–2. 0	. 14	6. 6–7. 8	Low	Low	Low.
100	90–100	70–85	36–50	2. 0–6. 3	. 12	5. 6–7. 3	Low	Low	Low or moderate.
100	100	90–100	70–90	2. 0–6. 3	. 14	7. 4–8. 4	Low	Low	Low.
100	100	90–100	70–90	0. 63–2. 0	. 14	6. 1–8. 4	Low	Low	Low.
100	100	90–100	60–75	0. 63–2. 0	. 14	7. 4–8. 4	Low	Low	Low.
100	100	85–95	60–75	0. 63–2. 0	. 14	7. 4–8. 4	Low	Low	Low.
100	100	90–100	15–35	0. 63–2. 0	. 12	6. 1–7. 3	Low	Low	Low.
100	100	90–100	40–60	0. 63–2. 0	. 14	6. 1–7. 3	Low	Moderate	Low.
100	100	90–100	15–35	0. 63–2. 0	. 12	6. 6–7. 8	Low	Low	Low.
100	100	100	75–95	0. 63–2. 0	. 17	6. 6–7. 8	Moderate	Moderate	Low.
100	90–100	90–100	75–95	0. 63–2. 0	. 14	7. 4–8. 4	Low	High	Low.
100	100	90–100	85–95	0. 06–0. 2	. 17	6. 1–7. 3	Moderate	Moderate	Low.
100	100	90–100	90–98	<0. 06	. 17	6. 6–8. 4	High	High	Low.
100	100	90–100	90–100	0. 06–0. 2	. 17	7. 4–8. 4	High	High	Low.
100	100	70–85	36–50	0. 06–2. 0	. 12	5. 6–6. 5	Low	Moderate	Moderate.
100	100	90–100	55–85	<0. 06	. 17	7. 8–9. 0	Moderate	High	High.
100	100	85–95	55–85	0. 06–2. 0	. 14	8. 5–9. 0	Low	High	High.
100	100	90–100	60–85	0. 63–2. 0	. 14	6. 6–8. 4	Low	Low	Low.
100	100	70–90	40–50	2. 0–6. 3	. 12	7. 9–8. 4	Low	Low	Low.
100	100	100	75–95	0. 63–2. 0	. 17	7. 9–8. 4	Moderate	Moderate	Low.
100	100	50–90	5–10	2. 0–6. 3	. 05	7. 9–8. 4	Low	Low	Low.

TABLE 5.—*Engineering*

[Not included in this table because their characteristics are too variable to be classified

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds: Reservoir area	Farm ponds: Embankment
Acme (AgD) (Gypsum outcrop part not rated.)	Fair: limited quantity of material.	Unsuitable	Fair in surface layer; limited quantity of material over gypsum.	Gypsum at a depth of 10 to 20 inches.	High seepage through gypsum.	Low stability; susceptible to piping.
Breaks (Bk)	Poor: limited quantity of material.	Unsuitable	Poor: clayey material; areas inaccessible.	Steep slopes along canyons and stream channels.	Areas good for natural storage.	Features favorable.
Cobb (CoB, CoC, CoD2, CoD, CrD3). (For interpretations of Grant soil in mapping unit CrD3, refer to the Grant series in this table.)	Fair: rock at a depth of 20 to 48 inches.	Poor: sandstone at a depth of 20 to 48 inches; poorly graded.	Fair: sandstone at a depth of 20 to 48 inches.	Features favorable.	Variable seepage; sandstone at a depth of 20 to 48 inches.	Features favorable.
Cyril (Cs, Cy)	Good: large quantity of fertile material.	Unsuitable	Fair: moderate shrink-swell potential; A–4 material.	Subject to flooding.	Moderate seepage; loamy sediment.	Moderate strength and stability.
Darnell (DaD3, DnD, DnE). (For interpretations of Noble soil in mapping units DnD and DnE, refer to the Noble series in this table.)	Fair: limited quantity of material.	Unsuitable	Fair: sandstone at a depth of less than 20 inches.	Variable slopes; sandstone near surface.	Moderate seepage; sandstone at a depth of less than 20 inches.	Limited amount of fill material.
Dill (Mapped only in a complex with Lucien soils.)	Fair: sandstone at a depth of 20 to 48 inches; moderately fertile.	Unsuitable	Good: shallow to sandstone; A–4 material.	Features favorable.	Moderate seepage; sandstone at a depth of 20 to 48 inches.	Moderate strength and stability.
Dougherty (DoB, DuD). (For interpretations of Eufaula soil in mapping unit DuD, refer to the Eufaula series in this table.)	Poor: low fertility.	Poor: poorly graded.	Good if soil binder is added.	Erodible soils	Moderate seepage; sandy.	Subsoil has high strength and stability; subject to erosion.
Eufaula (EfD, EuB, EuC).	Poor: low fertility; low available water capacity; highly erodible.	Fair: poorly graded.	Good if soil binder is added.	Erodible soils	Rapid seepage; sandy.	Low stability and shear strength; erodible.
Foard (FoA)	Good in surface layer; poor in other layers; A–7 material.	Unsuitable: fine-grained material.	Poor: high shrink-swell potential; A–7 material.	Highly plastic soil material.	Features favorable.	Moderate stability; subject to cracking.

interpretations of soils

are the Gypsum outcrop part of mapping unit AgD and Rock outcrop part of mapping unit TaE]

Soil features affecting—Continued					Degree and kind of limitations for sewage disposal—		Hydrologic soil group
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons	
Well drained	Shallow to bedrock; limited available water capacity.	Shallow to bedrock.	Shallow to bedrock.	Gypsum at a depth of 10 to 20 inches.	Severe: gypsum at a depth of 10 to 20 inches.	Severe: high seepage through gypsum.	C
Well drained	Sloping to moderately steep.	Variable slopes	Variable slopes	Variable slopes	Severe: variable slopes.	Severe: variable slopes.	D
Well drained	Variable slopes; moderate intake rate.	Variable slopes	Variable slopes	Sandstone at a depth of 20 to 48 inches.	Moderate: sandstone at a depth of 20 to 48 inches; variable slopes.	Moderate: moderate permeability; sandstone at a depth of 20 to 48 inches; variable slopes.	B
Well drained	Subject to flooding.	Features favorable.	Features favorable.	Subject to flooding.	Severe: subject to flooding; moderate percolation rate.	Severe: subject to flooding; moderate permeability.	B
Well drained; moderately rapid permeability.	Sloping; shallow to bedrock.	Shallow to sandstone.	Shallow to sandstone.	Sandstone at a depth of less than 20 inches.	Severe: depth to sandstone less than 20 inches.	Severe: sandstone at a depth of less than 20 inches; moderate seepage.	C
Well drained	Variable slopes; moderate intake rate.	Variable slopes	Erodible	Sandstone bedrock at a depth of 20 to 48 inches.	Severe: moderately rapid percolation rate; depth to sandstone less than 48 inches.	Moderate: moderate seepage; bedrock at a depth of less than 48 inches.	B
Well drained	Limited available water capacity; high seepage in ditches.	Erodible	Sandy surface layer erodible.	Poor stability in surface layer.	Slight: moderate percolation rate; high seepage below a depth of 61 inches.	Severe: high seepage through sandy layers.	A
Somewhat excessively drained.	Limited available water capacity; high intake rate.	Erodible; low stability.	Limited available water capacity; erodible.	Low stability; rapid permeability.	Slight to moderate; high seepage; variable slopes.	Severe: high intake rate; rapid permeability.	A
Moderately well drained; very slow permeability.	Low intake rate; nearly level.	Nearly level; high shrink-swell potential.	Vegetation difficult to establish in clayey material.	Unstable plastic clay.	Severe: very slow percolation rate.	Slight: high shrink-swell potential.	D

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
Gracemont (Gm)	Good: large quantity of material.	Unsuitable: fine-grained material.	Fair: water table at a depth of less than 40 inches.	Subject to flooding; high water table.	Site limited to dug ponds; high water table.	Features favorable.
Grant (GrB, GrC, GrC2, GrD, GwC). (For interpretations of Wing soil in mapping unit GwC, refer to the Wing series in this table.)	Good: high fertility.	Unsuitable: fine-grained material.	Fair: A–6 and A–4 material.	Sandstone below a depth of 40 inches.	Seepage through sandstone.	Moderate to high strength and stability.
Hollister (HoA)	Good in surface layer; layer below a depth of about 14 inches is A–7 material.	Unsuitable: fine-grained material.	Poor: high shrink-swell potential; A–7 material.	Highly plastic soil material below a depth of about 14 inches.	Features favorable.	Moderate stability; subject to cracking.
Konawa (KoC2, KsD3)	Fair: erodible	Unsuitable: fine-grained material.	Good: A–6 and A–2 material.	Variable slopes; erodible on cut slopes.	Moderate seepage; sandy material.	Material erodible.
Limestone cobbly land (Lm).	Poor: limited quantity of material.	Unsuitable: fine-grained material.	Fair: stones and cobblestones.	Variable slopes; shallow soil.	Low to high seepage; shallow to limestone; difficult to excavate.	Difficult to excavate.
Lucien (LuD, LuE) (For interpretations of Dill soil in these mapping units, refer to the Dill series in this table.)	Fair: limited quantity of material.	Unsuitable: fine-grained material.	Fair: sandstone at a depth of less than 20 inches.	Variable slopes; limited depth to sandstone.	Moderate seepage; shallow to sandstone; limited depth.	Limited quantity of fill material.
McLain (Mc)	Good in surface layer; clayey layer at a depth below 14 inches.	Unsuitable: fine-grained material.	Poor: high shrink-swell potential; A–7 material.	Plastic material below a depth of 14 inches.	Features favorable.	Moderate stability.
Miller (Me)	Fair: clayey material.	Unsuitable: fine-grained material.	Poor: highly plastic material.	Highly plastic soil material; subject to flooding.	Low seepage; clayey material; sites limited to dug ponds.	Subject to severe cracking.
Minco (MoD, MoE, MsC).	Good: large quantity of material.	Unsuitable: fine-grained material.	Good to fair: close moisture control needed.	Slopes and cuts erodible.	Moderate seepage; loamy material.	Material erodible.

interpretations of soils—Continued

Soil features affecting—Continued					Degree and kind of limitations for sewage disposal—		Hydrologic soil group
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons	
High water table; somewhat poorly drained.	Subject to flooding.	Nearly level; high water table; subject to flooding.	High water table.	High water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	B
Well drained	Variable slopes; other features favorable.	Features favorable.	Features favorable.	Features favorable.	Slight	Moderate: moderate percolation rate; variable slopes.	B
Well drained; slow permeability.	Low intake rate; nearly level.	High shrink-swell potential.	Features favorable.	High shrink-swell potential.	Severe: slow permeability.	Slight: subject to cracking.	D
Well drained	Moderate intake rate; variable slopes.	Erodible	Erodible	Poor stability	Slight	Severe: moderate permeability; high seepage through sandy layers.	B
Well drained	Shallow to limestone.	Shallow to limestone.	Shallow to limestone.	Shallow to limestone; high content of cobblestones.	Severe: shallow to limestone.	Severe: shallow to limestone.	D
Well drained; sandstone near surface.	Shallow to sandstone.	Shallow to sandstone.	Shallow to sandstone.	Shallow to sandstone.	Severe: shallow to sandstone.	Severe: shallow to sandstone.	C
Well drained	Nearly level; moderate intake rate.	Features favorable.	Features favorable.	High shrink-swell potential.	Severe: moderately slow permeability.	Slight: high shrink-swell potential.	C
Moderately well drained.	Low intake rate; subject to flooding.	Subject to flooding; nearly level; highly plastic.	Vegetation difficult to establish in clayey material; nearly level.	Subject to flooding; high shrink-swell potential.	Severe: very slow permeability; subject to flooding.	Severe: high shrink-swell potential; subject to flooding.	D
Well drained	Variable slopes.	Features favorable.	Features favorable.	Features favorable.	Slight	Moderate to severe; moderate permeability; variable slopes.	B

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
Noble (NoB, NoD)	Good: large quantity of material.	Unsuitable: fine-grained material.	Good: A-4 material.	Features favorable.	Moderate seepage; loamy material.	Features favorable.
Norge (NrB, NrC)	Good: large quantity of material.	Unsuitable: fine-grained material.	Fair to poor: unstable when wet.	Material unstable when wet; good subgrade drainage required.	Features favorable.	Features favorable.
Pond Creek (PcA, PcB, PkA, PkB, PkB2).	Good: large quantity of material.	Unsuitable: fine-grained material.	Fair to poor: unstable when wet.	Material unstable when wet.	Features favorable.	Features favorable.
Port (Po, Pp) (For interpretations of Pulaski soil in mapping unit Pp, refer to the Pulaski series in this table.)	Good: large quantity of material.	Unsuitable: fine-grained material.	Fair: unstable when wet.	Subject to flooding.	Features favorable for dug ponds.	Features favorable.
Pulaski (Pu)	Good: large quantity of material.	Unsuitable: too much fine-grained material.	Good: A-4 material.	Subject to flooding.	Level; moderate seepage through loamy material.	Moderate to high strength and stability.
Quinlan (QwD) (For interpretations of Woodward soil in mapping unit QwD, refer to the Woodward series in this table.)	Fair: limited quantity of material.	Unsuitable: fine-grained material.	Fair: sandstone or siltstone at a depth of less than 20 inches.	Variable slopes; shallow to sandstone.	Moderate seepage through sandstone; limited depth to sandstone.	Limited quantity of fill material.
Reinach (ReA, ReB, RhA).	Good: large quantity of material.	Unsuitable: fine-grained material.	Good: A-4 material.	Features favorable.	Moderate seepage through loamy material.	Moderate strength and stability.
Rough broken land (Ro).	Poor: limited quantity of material.	Unsuitable: fine-grained material.	Fair: sandstone or siltstone material at a depth of less than 20 inches.	Steep slopes; canyons and hills.	Limited depth to sandstone or siltstone.	Limited quantity of fill material.
Shellabarger (ShB, ShC).	Good: large quantity of material.	Unsuitable: fine-grained material.	Good: A-2 and A-4 material.	Features favorable.	Moderate seepage through loamy material.	Moderate to high strength and stability.
Talpa (TaE) (Rock outcrop part not rated.)	Poor: limited quantity of material.	Unsuitable: very shallow to bedrock.	Poor: very shallow to limestone.	Variable slopes; difficult to excavate.	Limited depth to limestone.	Limited quantity of fill material.

interpretations of soils—Continued

Soil features affecting—Continued					Degree and kind of limitations for sewage disposal—		Hydrologic soil group
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons	
Well drained	Variable slopes; moderate intake rate.	Features favorable.	Erodible on slopes.	Features favorable.	Slight	Severe: moderately rapid permeability.	B
Well drained	Features favorable.	Features favorable.	Features favorable.	Moderate shrink-swell potential.	Severe: moderately slow permeability.	Slight: moderately slow permeability.	B
Well drained	Features favorable.	Features favorable.	Features favorable.	Moderate shrink-swell potential.	Severe: moderate to moderately slow permeability.	Slight to moderate: moderately slow to moderate permeability.	B
Well drained	Subject to flooding; other features favorable.	Features favorable.	Features favorable.	Subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding; moderate permeability.	B
Well drained	Moderate intake rate; subject to flooding.	Subject to flooding.	Features favorable.	Subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding; moderately rapid permeability.	B
Well drained	Shallow to sandstone.	Shallow to sandstone.	Shallow to sandstone.	Shallow to sandstone.	Severe: shallow to sandstone.	Severe: shallow to sandstone; moderate seepage.	C
Well drained	Features favorable.	Features favorable.	Features favorable.	Features favorable.	Moderate: moderate permeability.	Moderate: moderate permeability.	B
Variable slopes	Shallow to bedrock.	Steep slopes	Steep slopes	Shallow to bedrock; variable slopes.	Severe: shallow to bedrock.	Severe: steep slopes; shallow to bedrock.	D
Well drained	Variable slopes; moderate intake rate.	Features favorable.	Features favorable.	Features favorable.	Slight: moderate permeability.	Moderate: moderate permeability.	B
Well drained	Very shallow to limestone.	Very shallow to limestone.	Very shallow to limestone.	Very shallow to limestone.	Severe: very shallow to limestone.	Severe: very shallow to limestone.	D

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as source of— Topsoil	Sand and gravel	Road fill	Soil features affecting— Highway location	Farm ponds: Reservoir area	Farm ponds: Embankment
Tillman (TlB, TlC, TlC2).	Good in surface layer; other layers have high content of clay.	Unsuitable: fine-grained material.	Poor: A-7 material; high shrink-swell potential.	Highly plastic	Features favorable.	Moderate stability; subject to cracking.
Vernon (VeD)	Poor: high content of clay.	Unsuitable: fine-grained material.	Poor: A-7 material; high shrink-swell potential.	Highly plastic	Features favorable.	Subject to cracking.
Wing (Mapped only in a complex with Grant soils.)	Poor: easily dispersed soil material; low fertility.	Unsuitable: fine-grained material.	Poor: easily dispersed soil material.	Readily dispersed soil material.	Low stability; easily dispersed soil material.	Low stability
Woodward (WuC) (For interpretations of Quinlan soil in this mapping unit, refer to the Quinlan series in this table.)	Fair: limited quantity of material.	Unsuitable: fine-grained material.	Fair: bedrock at a depth of 20 to 36 inches.	Variable slopes; shallow to bedrock.	Shallow to bedrock; moderate seepage; loamy material.	Moderate strength and stability.
Yahola (Ya)	Good: large quantity of material.	Unsuitable: fine-grained material.	Good: A-4 material.	Subject to flooding.	Level; moderate seepage; loamy material.	Features favorable.

tion and performance of surface and subsurface drainage practices. Among the factors that affect drainage are permeability, texture, structure, presence of a restricting layer, depth to the water table, and relief.

Some of the characteristics of the soils considered in evaluating the suitability of a soil for irrigation are the slope and depth of the soil, available water capacity, permeability, and the rate of intake of water.

Also shown in table 5 are features of the soils that determine suitability of the soils for terraces and diversions. Soil texture and slope, number of stones in the soil, nearness of bedrock to the surface, and the hazards of erosion and flooding are among the features considered.

Suitability of the soils for grassed waterways is based mainly on the stability, texture, and thickness of the soil material. Also considered are steepness of the slope and the difficulty of establishing and maintaining a good cover of plants.

Ratings for foundations for low buildings are based on limitations of an undisturbed soil when used for commercial and light industrial developments, primarily for buildings no more than three stories high. Specific values of bearing strength are not assigned.

Limitations of the soils for use as drainage fields for septic tanks and for use as sewage lagoons, and soil features that affect their use for these purposes, are also shown in table 5. The main limiting factors are slow permeability, susceptibility to flooding, and steep slopes. Shallowness to bedrock also is a limiting factor.

A rating of *slight* means that the soil generally is well suited to use as disposal fields for septic tanks or for use as sewage lagoons. A rating of *moderate* means that the soil generally is suitable, but the suitability is borderline and careful investigation is needed at the site being considered. The rating *severe* means that the soil is suitable only if care is used in planning and installing the system for disposal of sewage.

Soils that are rated moderate generally require larger drainage fields than those having slight limitations. Some of the soils rated severe are not suitable for use for sewage disposal, and all soils that have a severe rating should be carefully investigated at the proposed site. Soils subject to flooding, for example, should not be used as disposal fields for septic tanks or for sewage lagoons.

A hydrologic soil group is a group of soils that have the same runoff potential under a storm of given intensity

interpretations of soils—Continued

Soil features affecting—Continued					Degree and kind of limitations for sewage disposal—		Hydrologic soil group
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons	
Well drained	Low intake rate.	High shrink-swell potential; subject to cracking.	Difficult to establish vegetation; clayey material.	High shrink-swell potential.	Severe: very slow permeability.	Slight: high shrink-swell potential.	C
Well drained	Low intake rate.	Subject to cracking.	Difficult to establish vegetation; clayey material.	High shrink-swell potential.	Severe: slow permeability.	Moderate: limited depth to bedrock; high shrink-swell potential.	D
Somewhat poorly drained.	Low intake rate.	Readily dispersed soil material.	Vegetation difficult to establish.	Low stability	Severe: very slow permeability.	Severe: low stability.	D
Well drained	Variable slopes; shallow to bedrock.	Features favorable.	Features favorable.	Features favorable.	Severe: limited depth to bedrock.	Severe: limited depth to bedrock.	B
Well drained	Moderate intake rate; subject to flooding.	Subject to flooding.	Features favorable.	Subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding; moderately rapid permeability.	B

and under similar kinds of cover. The groupings express the intake of water at the end of storms during which soils have been made wet and have swelled. Four hydrologic soil groups are given. They range from sandy soils that have the lowest runoff potential (group A) to soils that consist mostly of clay and have the highest runoff potential (group D).

Engineering test data

Table 6 contains the results of engineering tests performed by the Oklahoma Department of Highways on 3 soils in Caddo County. The table gives the specific location where samples were taken, the depth to which sampling was done, and the results of tests to determine particle-size distribution and other properties significant in soil engineering.

The column heading "Shrinkage" lists values for shrinkage limit and shrinkage ratio. As moisture is removed, the volume of a soil decreases in direct proportion to the loss of moisture until the shrinkage limit is reached. Beyond the shrinkage limit, more moisture may be removed, but the volume of the soil does not change. In general, the lower the number listed in table 6 for the shrinkage limit the higher the content of clay.

The shrinkage ratio is the volume change, expressed as the percentage of dry soil material, divided by the loss of moisture caused by drying. This ratio is expressed numerically.

Volume change from available moisture capacity is the volume change, expressed as a percentage of the dry volume of the soil mass, when moisture content is reduced from the available water capacity to the shrinkage limit. It is the minimum content of moisture at which a smooth surface of undisturbed soil will absorb no more water in 30 seconds, when the water is added in individual drops. This is the amount of moisture required to fill all the pores in sands and to approach saturation in cohesive soils that have not been disturbed.

Mechanical analysis in table 6 shows the percentages, by weight, of soil particles that would pass sieves of specified sizes. Sand and other coarse materials do not pass through the No. 200 sieve, but silt and clay do pass through it. Silt is that material larger than 0.002 millimeter in diameter that passes through the No. 200 sieve, and clay is that fraction passing through the No. 200 sieve that is

TABLE 6.—*Engineering*

[Tests performed by the Oklahoma Department of Highways in accordance with standard

Soil name and location	Oklahoma report No.	Depth	Shrinkage	
			Limit	Ratio
Minco very fine sandy loam, 3 to 8 percent slopes:	SO-	*Inches*	*Percent*	
1,150 feet N. and 100 feet E. of SW. corner, sec. 10, T. 8 N., R. 10 W. (Modal).	5586	0–12	(4)	(4)
	5587	20–60	(4)	(4)
Noble fine sandy loam, 1 to 3 percent slopes:				
400 feet S. and 100 feet E. of NW. corner of SW¼, sec. 31, T. 7 N., R. 10 W. (Modal).	5584	9–22	(4)	(4)
	5585	36–72	(4)	(4)
Norge silt loam, 3 to 5 percent slopes:				
1,260 feet W. and 100 feet N. of SE. corner, sec. 8, T. 5 N., R. 10 W. (Modal).	5579	0–5	17	1. 77
	5580	12–36	12	1. 95
	5581	46–58	14	1. 89

[1] Mechanical analyses according to the AASHO Designation T 88–57 (*1*). Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses data used in this table are not suitable for use in naming textural classes for soil.

smaller than 0.002 millimeter in diameter. The clay fraction was determined by the hydrometer method, rather than the pipette method used by most soil scientists.

Liquid limit and plastic limit indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material passes from a plastic to a liquid state. The *plastic limit* is the moisture content at which the soil material passes from a semisolid to a plastic state. The *liquid limit* is the moisture content at which the material changes from a plastic to a liquid state. The *plasticity index* is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Formation and Classification of Soils

In this section the factors that affect the formation of the soils in Caddo County are discussed. Then the current system of soil classification is explained and the soils are placed in higher categories. The soil series in the county, including a profile representative of each series, are described in the section "Descriptions of the Soils."

Factors of Soil Formation

Soil is the product of the interaction of the five major factors of soil formation—climate, parent material, plants and animals (especially vegetation), relief, and time. If in one area, the climate, vegetation, or some other of these factors is different from that in another area, but the other four factors are the same, the soil formed in one area differs from that formed in the other area.

Climate.—Caddo County has a dry, subhumid, continental climate. Summers are hot and generally are dry. Winters are mild though severe cold spells sometimes occur. Rainfall is heaviest in spring and often is of high intensity.

Because of strong winds and high temperatures, the rate of evaporation is high. Consequently, except in the more permeable sandy soils, little water moves through the soils. Thus, the basic elements are not depleted by leaching. The presence of a lime zone in many of the soils indicates the average depth to which water moves.

Parent material.—Parent material, the unconsolidated mass from which soils form, has a direct influence on the physical, chemical, and mineralogical composition of the soils. The soils in Caddo County formed mainly in material weathered from sandstone, shale, limestone, and gypsum and alluvium from those materials.

Soils that formed in material weathered from sandstone are the Cobb, Darnell, Dill, Grant, Lucien, Noble, Quinlan, Wing, and Woodward and the miscellaneous land types, Breaks and Rough broken land. Alternating strata of sandstone, shale, and siltstone occur in the parent material of some of these upland soils. The Foard, Hollister, Tillman, and Vernon soils, also on uplands, formed primarily in material weathered from shale. Clay parent material occurs in some of these soils. Soils that formed primarily in the alluvium and wind-laid material along uplands of major streams are the Dougherty,

test data

procedures of the American Association of State Highway Officials (AASHO) (*1*)]

Volume change from available water capacity	Mechanical analysis [1]					Liquid limit	Plasticity index	Classification	
	Percentage passing sieve—		Percentage smaller than—						
	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.			AASHO [2]	Unified [3]
Percent						*Percent*	*Percent*		
(4)	[5] 99	57	31	10	8	(4)	(4)	A-4(4)	ML
(4)	[5] 99	55	27	9	7	(4)	(4)	A-4(4)	ML
(4)	100	50	29	10	7	(4)	(4)	A-4(3)	SM
(4)	100	41	23	12	10	(4)	(4)	A-4(1)	SM
14	100	91	65	21	17	25	5	A-4(8)	ML-CL
51	100	97	90	43	37	42	20	A-7-6(12)	CL
34	100	90	80	30	20	36	15	A-6(10)	CL

[2] The Oklahoma Department of Highways classification procedure further subdivides the AASHO A-2-4 subgroup into the following: A-2-3(0) if the plasticity index equals nonplastic; A-2(0) if the plasticity index equals nonplastic to 5; and A-2-4(0) if the plasticity index is 5 to 10.

[3] The Soil Conservation Service and the Bureau of Public Roads have agreed that all soils having a plasticity index within 2 points from A-line are to be given a borderline classification.

[4] Nonplastic.

[5] 100 percent of the material in this layer passed the No. 10 (2.0 mm. sieve).

Eufaula, Konawa, Minco, Norge, Pond Creek, and Shellabarger. Soils that formed in alluvium on flood plains are the Cyril, Gracemont, McLain, Miller, Port, Pulaski, Reinach, and Yahola. Acme soils formed on uplands in material weathered from gypsum. The parent material of Talpa soils and minor areas of the land type Rough broken land, which are on uplands, is limestone.

Plants and animals.—Plants, burrowing animals, insects, and micro-organisms have a direct influence on the formation of soils. The native grasses and trees in the county have had different effects on the losses and gains of organic matter and plant nutrients, and on soil structure and porosity. The Pond Creek, Minco, Norge, and Grant soils formed under native grasses. The fibrous roots of these native grasses promote good granular structure and add organic matter to the soil. Large amounts of plant nutrients are retained in the soil formed under native grass. The roots take in nutrients from deep in the soil and return a large part of them when the grass dies. Consequently, the soils in Caddo County that formed under native grass are less acid than soils formed under trees. The Dougherty soils, which formed under scrub oaks, are more acid and lower in content of organic matter than the soils formed under grass.

During the past 60 years man has altered the natural soil-forming processes in much of the county. In clearing the land and in cultivating the soils, man has caused severe loss of soils through sheet and gully erosion.

Relief.—Relief affects the formation of soils through its influence on moisture, drainage, erosion, temperature of the soil, and plant cover. In Caddo County relief is determined largely by the resistance of underlying formations to weathering and geological erosion. About 10 percent of Caddo County consists of nearly level soils on bottom lands, and 90 percent consists of nearly level to steep soils on uplands.

The general relief of the county is fairly uniform, but geological erosion has dissected broad plains and has cut drainageways in them. Because of this cutting, differences in elevation are distinct. The steeper part of the county includes the forests of scrub oak and limestone hills. The highest relief is on the prairies in the northern part of the county.

Relief has had a strong influence on the formation of different profile characteristics in the Hollister, Tillman, and Vernon soils that all formed in clayey material. Because the Hollister soils are nearly level and less water runs off the surface than from the more sloping Tillman and Vernon soils, more water percolates through the profile of the Hollister soils. This percolation influences the loss, gain, or transfer of soil constituents and of other soil-forming processes. Tillman and Vernon soils occur in the same general area as the Hollister soils but are more reddish. Tillman soils are very gently sloping to gently sloping, but Vernon soils are more sloping. The influence of relief reduces the soil-forming processes on the Tillman and Vernon soils as compared to the Hollister soils.

Cobb and Darnell soils formed on uplands from similar sandstone parent material; their development has been controlled largely by relief. Cobb soils are less sloping than Darnell soils. Much of the rainfall runs off Darnell soils and does not move through the profile. If the water

did move through the profile, it would promote development of a deeper solum.

The relief of the bottom lands is closely related to soil drainage. The level to slightly depressional Miller soils are moderately well drained, but the nearly level Port and Pulaski soils are well drained.

On the upper end of Tonkawa Creek some soils that were recently not tillable because of a high water table are now cultivated. Deepening of natural channels lowered the water table sufficiently to aerate these soils and permit farming.

Time.—As a factor in soil formation, time cannot be measured strictly in years. The length of time needed for a soil to develop genetic horizons depends on the intensity and interreaction of the soil-forming factors in promoting losses, gains, transfers, or transformations of soil constituents that are necessary for forming soil horizons. Soils that have no definite genetic horizons are young or immature. Mature soils are older soils that have approached equilibrium with their environment and have well-defined horizons.

The soils of Caddo County range from young to old. Some of the old soils are the Hollister, Tillman, and Foard on uplands. Pond Creek, Norge, and Grant soils are younger soils, but they have well-expressed soil horizons. The Vernon, Lucien, and Darnell soils are considered young soils. They have had sufficient time to develop well-expressed horizons, but because they are sloping, geological erosion has taken away soil material as fast, or almost as fast, as it has formed. The Yahola, Port, Pulaski, and Miller soils are on bottom lands and have been developing for such a short time that they show little horizon development. McLain soils formed in loamy alluvium similar to that in which Port soils formed, but this material has been in place long enough for the development of distinct layers.

Processes of Horizon Differentiation

Important processes in the formation of soil horizons in Caddo County are (1) accumulation of organic matter, (2) leaching of calcium carbonates, and (3) translocation of silicate clay minerals. In most soils, more than one of these processes have been active in the development of horizons. Some processes have retarded horizon differentiation.

By adding organic matter to the surface layer, native grasses have contributed to the granular structure of that layer in soils on the prairies. The Pond Creek soils have a granular surface layer that is high in content of organic matter. Dougherty soils formed under native trees on uplands and are low in organic matter.

Leaching of calcium carbonates is an active process in the development of soils. In the Hollister, Tillman, and Foard soils the accumulation of calcium carbonates in the lower part of the B horizon indicates the depth to which water has percolated. The Dougherty and Eufaula soils have a distinct eluviated A2 horizon. In these soils the leaching of bases from the B horizon is reflected in their base saturation.

Young alluvial soils, such as the Yahola, are recharged with bases during each flood. The acid Pulaski soils have not been leached, but the sediment deposited on these soils comes from the acid Noble and Darnell soils.

The translocation of silicate clay minerals has contributed to horizon development in some of the soils of Caddo County. Illuviation of clay is significant in the formation of clayey horizons. These horizons can be identified by the clay films along the vertical and horizontal surfaces of peds and by the increase in total clay. An A horizon containing translocated clay occurs in the Hollister, Norge, Pond Creek, Tillman, and other soils in the county. The texture and structure of the clayey horizons in the soils of Caddo County vary considerably because of the variation in the degree of translocation of silicate clay minerals and in variation in the kind of parent material. The Dougherty, Eufaula, and Konawa soils have a surface layer that is more leached of silicate clay minerals than the surface layer of other soils in the county.

The grasses on the soils of the prairie bring bases to the surface and thus retard leaching and the formation of an A2 horizon. Erosion on the Darnell, Lucien, and Vernon soils hinders the formation of horizons through soil losses.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see the relationships to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First, through classification and then through the use of soil maps, we can apply our knowledge of soils to specific fields or other tracts of land.

Thus, in classification soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and applied in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

Two systems of classifying soils have been used by the United States in recent years. The older system was adopted in 1938 (*2*) and later revised (*4*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. The current system is under continual study (*3*, *6*). Therefore, readers interested in development of this system should search the latest literature available. In table 7 the soil series represented in Caddo County are placed in higher categories of the current system.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar origin are grouped. The classes of the current system are briefly defined in the paragraphs that follow.

ORDERS: Ten soil orders are recognized. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. The two exceptions, Entisols and Histosols, occur in many different climates. The four orders in Caddo County are *Alfisols*, *Entisols*, *Inceptisols*, and *Mollisols*.

TABLE 7.—*Soil series classified according to the current system of classification* [1]

Series	Family	Subgroup	Order
Acme	Loamy, mixed, thermic, shallow	Torriorthentic Haplustolls	Mollisols.
Cobb	Fine-loamy, mixed, thermic	Udic Haplustalfs	Alfisols.
Cyril	Coarse-loamy, mixed, thermic	Cumulic Haplustolls	Mollisols.
Darnell	Loamy, siliceous, thermic, shallow	Udic Ustochrepts	Inceptisols.
Dill	Coarse-loamy, mixed, thermic	Udic Ustochrepts	Inceptisols.
Dougherty	Loamy, mixed, thermic	Arenic Haplustalfs	Alfisols.
Eufaula	Sandy, siliceous, thermic	Psammentic Paleustalfs	Alfisols.
Foard	Fine, montmorillonitic, thermic	Typic Natrustolls	Mollisols.
Gracemont	Coarse-loamy, mixed, calcareous, thermic	Typic Udifluvents	Entisols.
Grant	Fine-silty, mixed, thermic	Udic Argiustolls	Mollisols.
Hollister	Fine, mixed, thermic	Pachic Paleustolls	Mollisols.
Konawa	Fine-loamy, mixed, thermic	Ultic Haplustalfs	Alfisols.
Lucien	Loamy, mixed, thermic, shallow	Udic Haplustolls	Mollisols.
McLain	Fine, mixed, thermic	Pachic Argiustolls	Mollisols.
Miller	Fine, mixed, thermic	Vertic Haplustolls	Mollisols.
Minco	Coarse-silty, mixed, thermic	Udic Haplustolls	Mollisols.
Noble	Coarse-loamy, siliceous, thermic	Udic Ustochrepts	Inceptisols.
Norge	Fine-silty, mixed, thermic	Udic Paleustolls	Mollisols.
Pond Creek [2]	Fine-silty, mixed, thermic	Pachic Argiustolls	Mollisols.
Port	Fine-silty, mixed, thermic	Cumulic Haplustolls	Mollisols.
Pulaski	Coarse-loamy, mixed, nonacid, thermic	Typic Ustifluvents	Entisols.
Quinlan	Loamy, mixed, thermic, shallow	Typic Ustochrepts	Inceptisols.
Reinach	Coarse-silty, mixed, thermic	Pachic Haplustolls	Mollisols.
Shellabarger	Fine-loamy, mixed, thermic	Udic Argiustolls	Mollisols.
Talpa	Loamy, mixed, thermic	Lithic Haplustolls	Mollisols.
Tillman	Fine, mixed, thermic	Typic Paleustolls	Mollisols.
Vernon	Fine, mixed, thermic	Typic Ustochrepts	Inceptisols.
Wing [3]	Fine, mixed, thermic	Aquic Natrustalfs	Alfisols.
Woodward	Coarse-silty, mixed, thermic	Typic Ustochrepts	Inceptisols.
Yahola	Coarse-loamy, mixed, calcareous, thermic	Typic Ustifluvents	Entisols.

[1] Placement of some soil series in the current system of classification, particularly in families, may change as more information becomes available.

[2] The Pond Creek fine sandy loams are taxadjuncts to the Pond Creek series. They contain more sand throughout the solum but are enough like the Pond Creek series in morphology, composition, and behavior that a new series is not warranted.

[3] These soils are taxadjuncts to the Wing series. They contain slightly less than 35 percent clay in the upper 20 inches of the Bt horizon but are enough like the Wing series in morphology, composition, and behavior that a new series is not warranted.

Alfisols have a clay-enriched B horizon that is high in base saturation. In Caddo County the Alfisols are characterized by an eluvial A2 horizon and an illuvial B horizon.

Entisols are recent soils that lack genetic horizons or have only the beginnings of such horizons. The sandy soils in Caddo County on bottom lands that lack mollic epipedons are included in this order.

Inceptisols are mineral soils in which horizons have definitely started to develop. They generally are on young but not recent land surfaces. In Caddo County the Inceptisols include some soils that have diagnostic horizons but that show weak eluviation or illuviation.

Mollisols have formed mostly under grass. They have a thick, friable, dark-colored surface layer that has a high content of organic matter. Base saturation is more than 50 percent.

SUBORDERS: Each order is subdivided into suborders, primarily on the basis of those soil characteristics that seem to produce classes having the greatest similarity from the standpoint of their genesis. Suborders narrow the broad climatic range of soils that are in the orders.

Soil characteristics used to separate suborders mainly reflect either the presence or absence of waterlogging, or soil differences produced through the effects of climate or vegetation.

GREAT GROUPS: Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and other features. The horizons used as a basis for distinguishing between great groups are those in which clay, iron, or humus have accumulated; or those in which a pan has formed that interferes with growth of roots, movement of water, or both; or a thick, dark-colored surface horizon has formed. The other features used are the self-mulching properties of clay, temperature of the soil, major differences in chemical composition (mainly the bases calcium, magnesium, sodium, and potassium) or the dark-red or dark-brown colors associated with soils formed in material weathered from basic rock. The great group is not shown in table 7, because it is the last word in the name of the subgroup.

SUBGROUPS: Great groups are subdivided into subgroups. One of these represents the central, or typic, segment of the group. Other subgroups have properties of the group but have one or more properties of another great group, suborder, or order, and these are called intergrades. Also, subgroups may be established for soils having properties that intergrade outside the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Natrustolls.

FAMILIES: Families are separated within a subgroup primarily on the basis of properties that are important to the growth of plants or to the behavior of soils used for engineering. The main properties considered are texture, mineralogy, reaction, soil temperature, permeability,

thickness of horizons, and consistence. The names of families consist of a series of adjectives that precede the name of a subgroup. The adjectives used are the class names for soil texture, mineralogy, and so on (see table 7). An example is the fine-loamy, mixed, thermic family of Udic Haplustalfs.

General Nature of the County

In 1970, according to the U.S. Census, Caddo County had a population of 28,176, and 6,568 of this number lived in Anadarko, the county seat. About 11 percent of the people in the county were Indians. A Bureau of Indian Affairs area office is at Anadarko, as well as an Indian school for grades 7 through 12. In addition grammar schools and high schools are available in all parts of the county, and churches also are available. Among the cultural facilities near Anadarko are the Indian Hall of Fame and the Southern Great Plains Museum. Each summer an Indian Exposition held at Anadarko draws visitors from afar.

The production of oil and gas is the largest industry in Caddo County. Most oil and gas is produced in the southern part of the county, and a petroleum refinery is located at Cyril.

A modern carpet mill is in Anadarko, and a furniture manufacturing center is in Carnegie. Two large electrical generating plants are in the county. These plants furnish power to large areas in the western part of Oklahoma.

Several stone quarries are in the southern part of the county. They produce mostly limestone or sandstone for use as road material. Gypsum occurs in several places. It is mined by the open pit method, chiefly for farm use. Dolomite from the hills west of Hinton is quarried for building stone. Much of this colorful stone is used locally, though some is sold outside the county.

The county has several sand and gravel pits. A few large open pits near the South Canadian River in the northwestern part of the county process sand by screening, washing, and drying for use in building. Most of the gravel pits are in the southern part of the county. The gravel obtained makes excellent material for surfacing roads.

Recreational facilities are available throughout the county and in nearby counties. Fort Cobb Reservoir, Public Service Lake, and Chickasha Lake offer facilities for picnicking, camping, fishing, swimming, boating, skiing, and hunting in season. Streams, farm ponds, and structures built upstream for flood control also provide areas for many outdoor activities. Facilities for nature studies and hiking are available in the scenic hills and canyons in most parts of the county. In addition three golf courses are in the county.

Landowners, sports clubs, and the Oklahoma Wildlife Conservation Department are working together on a program to improve the habitat for fish and game. The program includes stocking fish and game to provide more suitable areas for hunting and fishing.

Climate [8]

Caddo County is in the southwestern part of Oklahoma and has a warm, temperate continental climate. This area receives the warmer, moisture-laden air from the Gulf of Mexico, which is regularly penetrated by the cooler drier air moving down from the Arctic Zone or approaching from the Pacific. When these two air systems meet, significant changes in temperature, precipitation, and wind velocity often occur.

The definite seasonal characteristics of the climate generally vary in intensity from year to year, but changes between seasons are gradual. Winters are mostly moderate and sunny. Temperatures often are fairly low and some snow falls, but the cold periods generally last only 2 to 5 days before they are moderated by a southerly wind. In spring and fall the heaviest seasonal rain occurs, and it benefits growing crops and pastures. Also, rains late in spring and early in summer generally are accompanied by the greatest number of severe local storms. Adequate moisture generally is received in spring for initial plant growth, but some replanting is needed occasionally.

Summers generally are long and hot, and the driest month is August. Brisk southerly breezes and low humidity often ease the discomforting effects of the hot spells. Valuable soil moisture, however, is lost from the soil at a faster rate during these hot spells. The autumn season has longer periods of pleasant days interspersed with soaking rains that benefit fall-seeded grain and pasture. Temperature and precipitation data for the county are given in table 8.

Caddo County has an average annual temperature of 61.9° F., and a range in temperature from 39.9° in January to 83.2° in August. The average daily variation of 26° provides a stimulating climate. Temperature extremes have ranged from 117° at Carnegie (August 12, 1936) to −17° at Anadarko (January 4, 1947). On similar dates in Apache, temperature extremes were 116° and −12°. Freezing temperatures occur on an average of 77 days a year from September through May, and on only 5 of these days does the daily high fail to exceed the freezing mark. In 1 year out of 3, a temperature of zero or below is recorded, and in 1930 a reading of zero was recorded on 5 days. The lowest average monthly temperature was 24.9° in January 1930, and the warmest winter recorded was that in 1931 when no temperature below 15° was recorded.

The hottest summer was in 1936 when 67 days had a temperature of 100° or higher. Temperatures of 90° or higher occur on an average of 99 days a year from January through October, and temperatures of 100° or higher occur on 29 days from April through October. From July 24, 1918 through August 22, 1918, there were 30 consecutive days of 100°. On 16 of these days the temperature was above 105°, and it was 110° on one of the days. The highest temperature in 1950, however, was 100°, and the temperature reached 90° or above on only 47 days. In that year the summer temperature averaged 4.1 degrees below normal.

[8] By STANLEY G. HOLBROOK, Oklahoma State climatologist, National Weather Service, U.S. Department of Commerce.

TABLE 8.—*Temperature and precipitation, at Apache, Caddo County, Okla.*

[Data from 1931–60]

Month	Temperature: Average daily maximum	Temperature: Average daily minimum	Temperature: 2 years in 10 will have at least 4 days with— Maximum temperature equal to or higher than—	Temperature: 2 years in 10 will have at least 4 days with— Minimum temperature equal to or lower than—	Precipitation: Average total	Precipitation: 1 year in 10 will have— Less than—	Precipitation: 1 year in 10 will have— More than—	Precipitation: Days with snow cover of 1 inch or more	Precipitation: Average depth of snow on days with snow cover
	°F.	*°F.*	*°F.*	*°F.*	*Inches*	*Inches*	*Inches*	*Number*	*Inches*
January	51. 8	28. 0	71	10	1. 39	0. 2	2. 9	3	2
February	56. 8	31. 6	74	15	1. 63	. 3	3. 0	1	3
March	64. 9	37. 5	82	22	2. 08	. 2	4. 7	1	2
April	74. 5	48. 3	88	34	2. 97	1. 0	5. 9	(1)	4
May	81. 6	57. 2	92	45	5. 87	1. 6	10. 6		
June	91. 2	66. 0	101	57	3. 79	1. 0	6. 6		
July	96. 4	69. 7	105	63	2. 75	. 3	6. 3		
August	97. 2	69. 2	107	61	2. 30	. 1	3. 9		
September	89. 2	61. 6	102	48	3. 34	. 1	8. 5		
October	77. 9	50. 7	92	37	2. 98	. 2	7. 9		
November	63. 4	37. 2	78	22	1. 55	0	4. 7		
December	54. 0	30. 6	71	18	1. 65	. 1	3. 2	1	3
Year	74. 9	49. 0	[2] 107	[3] 4	32. 30	20. 4	44. 4	6	3

[1] Less than 0.5 day.
[2] Average annual highest maximum.
[3] Average annual lowest minimum.

The average annual precipitation in Caddo County ranges from about 27 inches in the northwest to about 33 inches in the southeast. About 34 percent of the annual precipitation is in spring; 27 percent, in summer; 24 percent, in fall; and 15 percent, in winter. The highest amount of precipitation was recorded in 1923 when 41.43 inches was recorded at Carnegie and 48.16 inches was recorded at Apache. May is the wettest month, and it generally receives 18 percent of the annual precipitation. The highest monthly total precipitation at Anadarko was 11.64 inches in May 1955, and at Apache, 15.09 inches in June 1932. The highest precipitation recorded in a 24-hour period was 6.52 inches at Apache on September 21, 1957 and 8.60 inches at Carnegie on May 18, 1949. In about half of the recorded years, on an average of 1 to 3 days, Apache received a daily rainfall of 3.0 to 6.5 inches. The lowest yearly precipitation was in 1954 in Carnegie when only 14.92 inches was recorded. The lowest precipitation at Anadarko was in 1963 when 17.15 inches was recorded.

Precipitation in winter is provided partly by an average seasonal snowfall of about 7.2 inches. No measurable snowfall occurred in one winter out of 11, but 15 inches or more was recorded in 1 year out of 8. In the winter of 1920–21, a total of 21.5 inches of snow fell in the county. In the winter of 1947–48, the largest amount of snowfall, 27.7 inches, was recorded. The greatest monthly snowfall was 17.1 inches in January 1930, and the greatest daily snowfall was 10 inches on March 19, 1924 and on January 1 and March 10, 1948.

The average freeze-free season for Caddo County ranges from 204 days in the northwestern part to 210 days in the southeastern part. Average freeze dates vary across the county by several days. They are particularly variable in the northern part because the sharper landforms accelerate the drainage of cold air from the surface. Freezes have been as late as March 8, in 1946 at Apache, and May 3, in 1954 at Carnegie. Earliest fall freezes at Carnegie have occurred as early as September 29, in 1916, and as late as November 27, in 1965. The probabilities of first and last freezes in Caddo County are shown in table 9. Table 9 shows that a temperature of 20° or lower will occur after March 20 in 2 years out of 10, on the average. Similarly, a temperature of 32° or lower will occur before October 28 in about 5 years out of 10, on the average.

Records on wind, relative humidity, sunshine, and evaporation have not been kept in Caddo County, but estimates can be interpolated from nearby Oklahoma City and Wichita Falls, Texas. The prevailing wind is southerly except during January and February, when it is northerly. Wind velocity averages about 12.5 miles per hour and ranges from 11 miles per hour in August to 15 miles per hour in March and April. Gusts up to 80 miles an hour may occur near squall lines and during severe local thunderstorms. Relative humidity in August averages near 80 percent at 6 a.m. and around 44 percent at 6 p.m. In December the average relative humidity is about 80 percent at 6 a.m. and 64 percent at 6 p.m. Clear skies prevail in the county during 152 days of the year. Annual lake evaporation is 63 inches, 69 percent of which occurs from May through October.

A total of 48 tornadoes have been observed in the county in the last 91 years. On the average a tornado occurs in 2 out of every 9 years, and 75 percent of the tornadoes occur from April through June. Tornadoes have claimed 21 lives in the county, but none since March 1936. Damage to farms and towns also has occurred.

Forty-six damaging hailstorms have occurred in the county since 1924. A hailstorm occurs in the county on an average of 5 years out of 9. About 75 percent of the storms

TABLE 9.—*Probabilities of last freezing temperatures in spring and first in fall*

[All data from Apache and Carnegie for the period 1921–50]

Probability	Dates for given probability and temperature				
	16° F.	20° F.	24° F.	28° F.	32° F.
Spring:					
1 year in 10 later than	March 15	March 26	April 3	April 13	April 21
2 years in 10 later than	March 7	March 20	March 28	April 8	April 16
5 years in 10 later than	February 21	March 7	March 16	March 29	April 8
Fall:					
1 year in 10 earlier than	November 22	November 14	November 4	October 21	October 15
2 years in 10 earlier than	November 30	November 19	November 10	October 27	October 19
5 years in 10 earlier than	December 14	December 2	November 22	November 7	October 28

occur in the months of April through June, and two out of three of them occur between 4 p.m. and 8 p.m. The paths of these storms average 4 to 17 miles, and the storms generally move northeastward. Hailstones average about 1½ inches in diameter, but in three storms they measured as much as 3 to 4½ inches. Damage to crops generally is slight. In 1938, however, damage from hail at Carnegie was severe. Hailstones up to 2 inches in size pelted crops and property along a 4½- by 16-mile path.

Geology [9]

Caddo County is mainly in the Western Sandstone Hills area, but a small area of the county in the east-central part and a broad belt in the southwestern part are in the Central Red-bed Plains. The southwestern corner of the county is in the Limestone Hills section of the Wichita Mountain province. The geologic map of Caddo County is shown in figure 18.

The oldest rock exposed in the county is Carlton Rhyolite of Middle Cambrian age in the southwestern corner of the county. The rhyolite is overlain unconformably in the same areas by the Honey Creek formation of Late Cambrian age. This formation is brown sandstone in the lower part and limestone in the upper part. The Arbuckle Group of limestone and dolomite crops out in much of the southwestern corner of the county. The rocks exposed are 3,550 feet thick, and they consist of Late Cambrian and Early Ordovician beds that range from 270 to 1,100 feet in thickness. Underlying the two major ridges in the southwestern part of the county are 4,000 feet of limestone that flanks the Blue Creek Canyon anticline.

In the southwestern part of the county, 4,000 feet of limestone underlies the two prominent ridges that flank the Blue Creek Canyon anticline. The Post Oak Conglomerate, a 400-foot thick deposit of detritus that was eroded from the mountains in Permian time, overlaps, the older rocks in the southwestern part of the county. In Caddo County this formation consists of limestone cobblestones and pebbles, local sandstone, and red shale.

Above the Post Oak Conglomerate and in places interfingered with it, especially near the base, is the Hennessey Shale, a red clay shale that includes some sandstone. Above the Hennessey Shale is the El Reno group, which in the southwestern part of the county, south of Carnegie, is divided into the basal Flowerpot Shale, the gypsum-bearing Blaine formation, and the upper Dog Creek Shale. In the rest of this area, the El Reno group consists of the Duncan Sandstone and the Chickasha formation. The Chickasha formation is reddish to purplish coarse sandstone that has tongues and lenses of clay and is poorly bedded.

Above the Chickasha formation is the Whitehorse group, which consists of the Marlow formation, below, and the Rush Springs Sandstone, above. The Marlow formation underlies a 1- to 2-mile belt around the nose of the Anadarko syncline, and it consists of 120 feet of well-bedded, watermelon-pink sandstone. Near the middle of the formation is the Verden Sandstone lentil, a "shoe string" sand that caps isolated hills that extend in a long chain northwestward through Verden. In the upper part of the Marlow formation are two dolomite beds, the Relay Creek and the Emanuel.

The Rush Springs Sandstone is 140 to 280 feet thick and is the principal source of ground water in the area. It consists of red, cross-bedded sandstone and is the bedrock in two-thirds of the county. Around the town of Cement this sandstone is bleached to gray and is about 40 percent dolomite.

The highest Paleozoic unit is the Cloud Chief formation, which occurs in outliers at the axis of the Anadarko syncline at Cyril. This formation contains large quantities of gypsum.

In the valleys of streams that flow into the Washita River are terrace deposits of Late Pleistocene age. The deposits fill the valleys that earlier were cut into the bedrock. They consist of 25 feet of layered and massive sand underlain by up to 15 feet of blue-gray clay. Quaternary alluvium occurs along the Little Washita and Canadian Rivers and along Sugar Creek.

The pattern of bedrock outcrop is controlled by the Anadarko syncline. This syncline consists of a huge downwarp into which the rocks dip about 90 feet to a mile from the north and 200 feet per mile from the south.

Farming

Farming is the principal source of income in Caddo County. According to the 1964 Census of Agriculture, 95.4

[9] By CARL C. BRANSON, director, Oklahoma Geological Survey, University of Oklahoma.

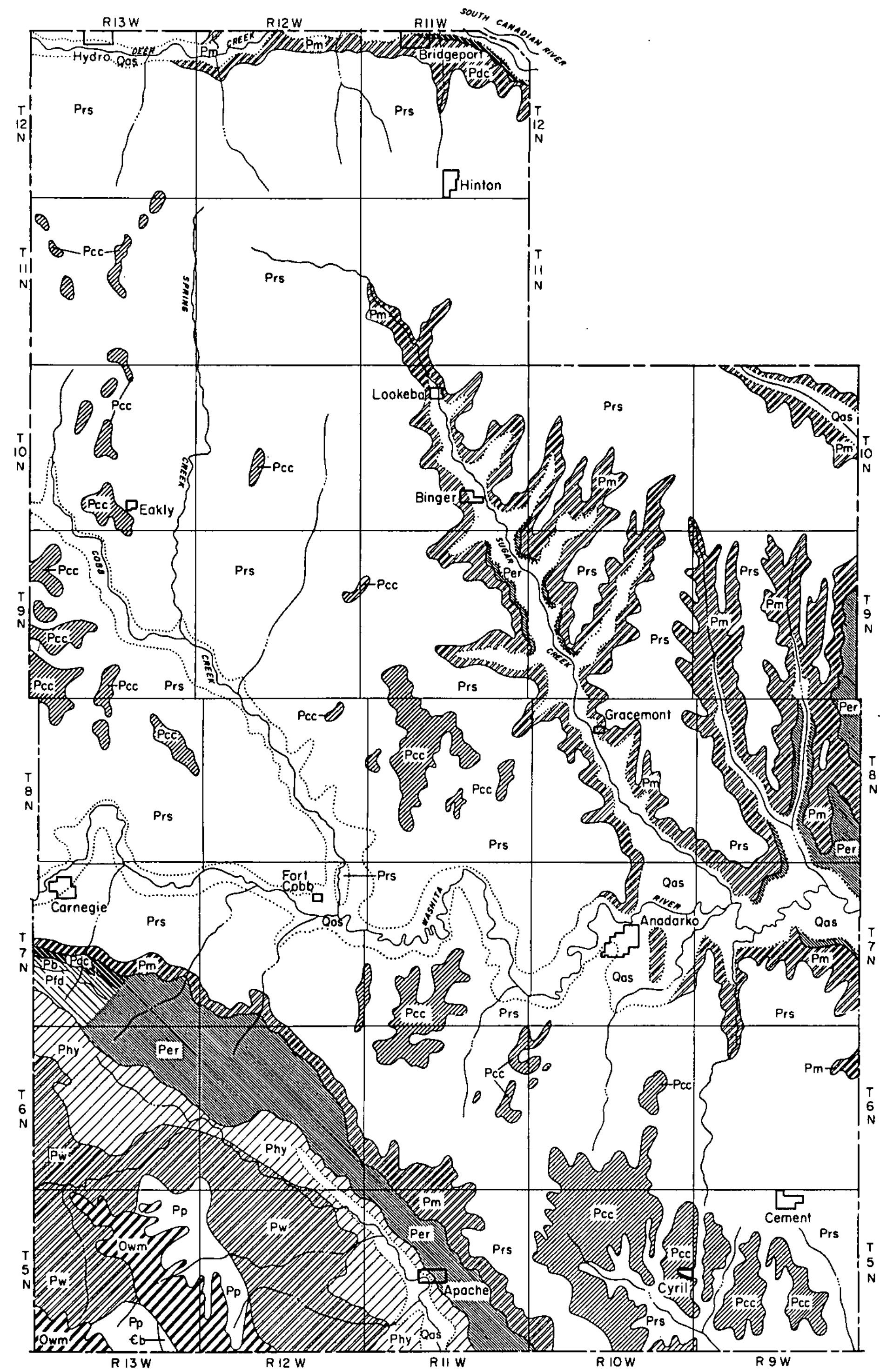

Figure 18.—**Geology of Caddo County, Okla.**

Quaternary:
- Qas Alluvium on first and second bottoms and low terraces

Permian:
- Pcc Cloud Chief formation
- Prs Rush Springs Sandstone (Whitehorse group)
- Pm Marlow formation (Whitehorse group)
- Per El Reno group
- Pdc Dog Creek Shale
- Pb Blaine Gypsum

Permian—Continued
- Pfd Flowerpot Shale and Duncan Sandstone
- Phy Hennessey Shale
- Pw Wichita formation
- Pp Post Oak Conglomerate member of Wichita formation

Ordovician:
- Owm Upper part of Arbuckle group

Cambrian:
- €b Lower part of Arbuckle group

percent of the total land in the county was in farms. The average size of the farms was 364 acres.

In the past cotton and corn were the major crops. With the advent of modern farm machinery, peanuts and wheat have become the major cash crops. The increased use of sprinkler irrigation in the past 10 to 15 years has been a major factor in the increased acreage in these crops, especially peanuts, which receive the major part of the irrigation water. Of 30,000 acres of peanuts in the county, 24,000 was irrigated in 1964. A commercial peanut shelling plant, two custom peanut shellers, a cold storage plant, and many peanut driers have been built to process the peanuts.

The acreage in wheat has not varied much since 1950. Yields have increased, however, because of the proper use of conservation practices and the good supply of moisture. Eleven grain elevators are strategically located in the county.

The acreage in cotton has steadily decreased, and the number of cottongins has decreased from 26 in 1954 to 15 in 1964. Other crops grown in the county are grain sorghum, alfalfa, barley, oats, wild hay, and grasses for tame pasture.

The general use of improved varieties of crops, modern farm equipment, fertilizer, irrigation, insecticides, weed control, and practices that conserve soil and water are all factors that have led to the increase in crop yields.

In the period from 1959 to 1964, the number of cattle and calves increased, but the number of poultry, sheep, and swine decreased. The acreage in improved pasture doubled. Three community livestock auctions provide local markets in the county, and the livestock market at nearby Oklahoma City also handles livestock from Caddo County.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Cover crop. A close-growing crop grown primarily to improve and to protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crusty soil. Soil tending to form a thin, massive or platy surface layer under the beating action of raindrops. The opposite of crusty is "self-mulching."

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Flood plain. Nearly level land, consisting of stream sediment, that borders a stream and is subject to flooding unless protected artificially.

Forb. Any herbaceous plant, neither a grass nor a sedge, that is grazed on western ranges.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers of material.

Internal drainage. The downward movement of water through the soil profile. The rate of movement is determined by the texture, structure, and other characteristics of the soil profile and underlying layers, and by the height of the water table, either permanent or perched. Relative terms for expressing internal drainage are *none, very slow, slow, medium, rapid,* and *very rapid.*

Leaching. The removal of soluble materials from soil or other materials by percolating water.

Minimum tillage. The least amount of tillage required for quick germination of seed, and a good stand.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 mllimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Natural soil drainage. Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and in Podzolic soils commonly have mottlings below 6 to 16 inches, in the lower A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

pH value. A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		pH
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher.
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Relief. The elevations or inequalities of a land surface, considered collectively.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays, where there is marked change in moisture content.

Slick spots. Small areas in a field that are slick when wet because they contain excess exchangeable sodium, or alkali.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips to serve as vegetative barriers to water erosion and soil blowing.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are (1) *single grain* (each grain by itself, as in

dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Stubble mulch. Stubble or other crop residues left on the soil, or partly worked into the soil, to provide protection from water erosion and soil blowing after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the soil series to which the mapping unit belongs. In referring to a capability unit, a range site, or a woodland suitability group, read the introduction to the section it is in for general information about its management. Other information is given in tables as follows:

Acreage and extent, table 1, p. 5.
Predicted yields, table 2, p. 38, and table 3, p. 40.
Engineering uses of the soils, tables 4, 5, and 6, pp. 48 through 61.

Map symbol	Mapping unit	Page	Capability unit: Dryland Symbol	Dryland Page	Irrigated Symbol	Irrigated Page	Range site Name	Range site Page	Woodland suitability group Number
AgD	Acme-Gypsum outcrop complex, 2 to 8 percent slopes	5							
	Acme part		VIIs-1	32	------	----	Loamy Prairie	37	4
	Gypsum outcrop part		VIIs-1	32	------	----	Gyp	40	4
Bk	Breaks	5	VIe-1	31	------	----	Loamy Prairie	37	3
CoB	Cobb fine sandy loam, 1 to 3 percent slopes	6	IIe-2	27	IIe-1	34	Sandy Prairie	37	2
CoC	Cobb fine sandy loam, 3 to 5 percent slopes	6	IIIe-2	29	IIIe-1	35	Sandy Prairie	37	2
CoD	Cobb fine sandy loam, 5 to 8 percent slopes	6	IVe-3	30	IVe-1	35	Sandy Prairie	37	3
CoD2	Cobb fine sandy loam, 3 to 8 percent slopes, eroded	6	IVe-4	30	IVe-1	35	Sandy Prairie	37	3
CrD3	Cobb and Grant soils, 3 to 8 percent slopes, severely eroded	6							
	Cobb part		VIe-2	31	------	----	Sandy Prairie	37	4
	Grant part		VIe-2	31	------	----	Loamy Prairie	37	4
Cs	Cyril fine sandy loam	7	IIw-1	28	IIw-1	35	Loamy Bottomland	43	1
Cy	Cyril fine sandy loam, noncalcareous variant	7	IIw-1	28	IIw-1	35	Loamy Bottomland	43	1
DnD	Darnell-Noble association, rolling	7							
	Darnell part		VIe-3	32	------	----	Shallow Savannah	42	4
	Noble part		VIe-3	32	------	----	Sandy Savannah	42	4
DnE	Darnell-Noble association, hilly	8							
	Darnell part		VIIe-2	32	------	----	Shallow Savannah	42	4
	Noble part		VIIe-2	32	------	----	Sandy Savannah	42	4
DaD3	Darnell soils, 3 to 12 percent slopes, severely eroded	8	VIIe-1	32	------	----	Eroded Shallow Savannah	42	4
DoB	Dougherty loamy fine sand, 1 to 3 percent slopes	9	IIIe-4	29	IIIe-2	35	Deep Sand Savannah	42	1
DuD	Dougherty and Eufaula loamy fine sands, 3 to 8 percent slopes	9	IVe-5	30	IVe-2	35	Deep Sand Savannah	42	2
EfD	Eufaula fine sand, rolling	10	VIs-1	32	------	----	Deep Sand Savannah	42	3
EuB	Eufaula loamy fine sand, 1 to 3 percent slopes	10	IVs-2	31	IVs-2	36	Deep Sand Savannah	42	2
EuC	Eufaula loamy fine sand, hummocky	10	IVe-5	30	IVs-2	36	Deep Sand Savannah	42	3
FoA	Foard silt loam, 0 to 1 percent slopes	10	IIs-1	28	IIs-1	34	Hardland	41	3
Gm	Gracemont soils	11	Vw-2	31	------	----	Subirrigated	43	3
GrB	Grant loam, 1 to 3 percent slopes	12	IIe-1	27	IIe-1	34	Loamy Prairie	37	2

Map symbol	Mapping unit	Page	Capability unit: Dryland Symbol	Dryland Page	Irrigated Symbol	Irrigated Page	Range site Name	Range site Page	Woodland suitability group Number
GrC	Grant loam, 3 to 5 percent slopes------------------	12	IIIe-1	29	IIIe-1	35	Loamy Prairie	37	2
GrC2	Grant loam, 3 to 6 percent slopes, eroded----------	12	IVe-2	30	IVe-1	35	Loamy Prairie	37	3
GrD	Grant loam, 5 to 8 percent slopes------------------	12	IVe-1	30	IVe-1	35	Loamy Prairie	37	3
GwC	Grant-Wing complex, 1 to 5 percent slopes----------	12							
	Grant part-----------		IVs-1	31	IVs-1	35	Loamy Prairie	37	3
	Wing part------------		IVs-1	31	IVs-1	35	Slickspot	40	3
HoA	Hollister silt loam, 0 to 1 percent slopes--------	13	IIc-1	28	I-2	34	Hardland	41	3
KoC2	Konawa loamy fine sand, 1 to 5 percent slopes, eroded------------------	13	IVe-6	30	IVe-1	35	Deep Sand Savannah	42	3
KsD3	Konawa soils, 2 to 8 percent slopes, severely eroded------------------	14	VIe-4	32	------	----	Deep Sand Savannah	42	4
Lm	Limestone cobbly land-----	14	VIIs-2	33	------	----	Limestone Ridges	43	4
LuD	Lucien-Dill fine sandy loams, 3 to 12 percent slopes------------------	14							
	Lucien part----------		VIe-5	32	------	----	Shallow Prairie	37	3
	Dill part------------		VIe-5	32	------	----	Sandy Prairie	37	3
LuE	Lucien-Dill fine sandy loams, 12 to 30 percent slopes------------------	14							
	Lucien part----------		VIIe-3	32	------	----	Shallow Prairie	37	4
	Dill part------------		VIIe-3	32	------	----	Sandy Prairie	37	4
Mc	McLain silty clay loam----	15	I-1	27	I-2	34	Loamy Bottomland	43	1
Me	Miller silty clay loam----	15	IIIw-1	29	IIIw-1	35	Heavy Bottomland	42	4
MsC	Minco silt loam, 3 to 5 percent slopes----------	16	IIIe-1	29	IIIe-1	35	Loamy Prairie	37	2
MoD	Minco very fine sandy loam, 3 to 8 percent slopes------------------	16	IVe-1	30	IVe-1	35	Loamy Prairie	37	2
MoE	Minco very fine sandy loam, steep-------------	16	VIe-1	31	------	----	Loamy Prairie	37	3
NoB	Noble fine sandy loam, 1 to 3 percent slopes-----	17	IIe-2	27	IIe-2	34	Sandy Savannah	42	1
NoD	Noble fine sandy loam, 3 to 8 percent slopes-----	17	IVe-3	30	IVe-2	35	Sandy Savannah	42	2
NrB	Norge silt loam, 1 to 3 percent slopes----------	18	IIe-1	27	IIe-1	34	Loamy Prairie	37	2
NrC	Norge silt loam, 3 to 5 percent slopes----------	18	IIIe-1	29	IIIe-1	35	Loamy Prairie	37	2
PcA	Pond Creek fine sandy loam, 0 to 1 percent slopes---	19	I-3	27	I-1	34	Sandy Prairie	37	1
PcB	Pond Creek fine sandy loam, 1 to 3 percent slopes---	19	IIe-2	27	IIe-1	34	Sandy Prairie	37	1
PkA	Pond Creek silt loam, 0 to 1 percent slopes--------	18	I-2	27	I-1	34	Loamy Prairie	37	2
PkB	Pond Creek silt loam, 1 to 3 percent slopes--------	18	IIe-1	27	IIe-1	34	Loamy Prairie	37	2
PkB2	Pond Creek silt loam, 1 to 3 percent slopes, eroded eroded------------------	18	IIIe-3	29	IIIe-1	35	Loamy Prairie	37	2
Po	Port silt loam-------------	20	IIw-2	28	IIw-2	35	Loamy Bottomland	43	1
Pp	Port and Pulaski soils, channeled---------------	20	Vw-1	31	------	----	Loamy Bottomland	43	1

Map symbol	Mapping unit	Page	Capability unit: Dryland Symbol	Dryland Page	Irrigated Symbol	Irrigated Page	Range site Name	Range site Page	Woodland suitability group Number
Pu	Pulaski soils	20	IIw-1	28	IIw-1	35	Loamy Bottomland	43	1
QwD	Quinlan-Woodward complex, 5 to 12 percent slopes	21							
	Quinlan part		VIe-6	32	------	----	Shallow Prairie	37	4
	Woodward part		VIe-6	32	------	----	Loamy Prairie	37	4
ReA	Reinach silt loam, upland, 0 to 1 percent slopes	22	I-2	27	I-1	34	Loamy Prairie	37	1
ReB	Reinach silt loam, upland, 1 to 3 percent slopes	22	IIe-1	27	IIe-1	34	Loamy Prairie	37	1
RhA	Reinach silt loam, 0 to 1 percent slopes	21	I-1	27	I-1	34	Loamy Bottomland	43	1
Ro	Rough broken land	22	VIIs-3	33	------	----	Breaks	44	4
ShB	Shellabarger fine sandy loam, 1 to 3 percent slopes	22	IIe-2	27	IIe-1	34	Sandy Prairie	37	1
ShC	Shellabarger fine sandy loam, 3 to 5 percent slopes	22	IIIe-2	29	IIIe-1	35	Sandy Prairie	37	2
TaE	Talpa-Rock outcrop complex, 5 to 30 percent slopes	23	VIIs-4	33	------	----	Edgerock	41	4
TlB	Tillman silty clay loam, 1 to 3 percent slopes	23	IIIe-5	29	IIIe-3	35	Hardland	41	3
TlC	Tillman silty clay loam, 3 to 5 percent slopes	23	IVe-7	31	IVe-3	35	Hardland	41	3
TlC2	Tillman silty clay loam, 2 to 5 percent slopes, eroded	24	IVe-8	31	IVe-3	35	Hardland	41	4
VeD	Vernon soils, 5 to 12 percent slopes	24	VIe-7	32	------	----	Red Clay Prairie	37	4
WuC	Woodward-Quinlan complex, 3 to 5 percent slopes	25							
	Woodward part		IVe-1	30	IVe-1	35	Loamy Prairie	37	3
	Quinlan part		IVe-1	30	IVe-1	35	Shallow Prairie	37	3
Ya	Yahola soils	26	IIw-1	28	IIw-1	35	Loamy Bottomland	43	1

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1400 Independence Avenue, S.W.
Washington, DC 20250-9410

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SOIL ASSOCIATIONS*

1 Port-Gracemont-Pulaski association: Deep, loamy and sandy, nearly level soils on flood plains

2 Pond Creek-Minco association: Deep, loamy, nearly level to steep soils on uplands

3 Pond Creek-Cobb association: Deep and moderately deep, loamy, nearly level to sloping soils on uplands

4 Grant-Pond Creek-Lucien association: Deep and shallow, loamy, nearly level to steep soils on uplands

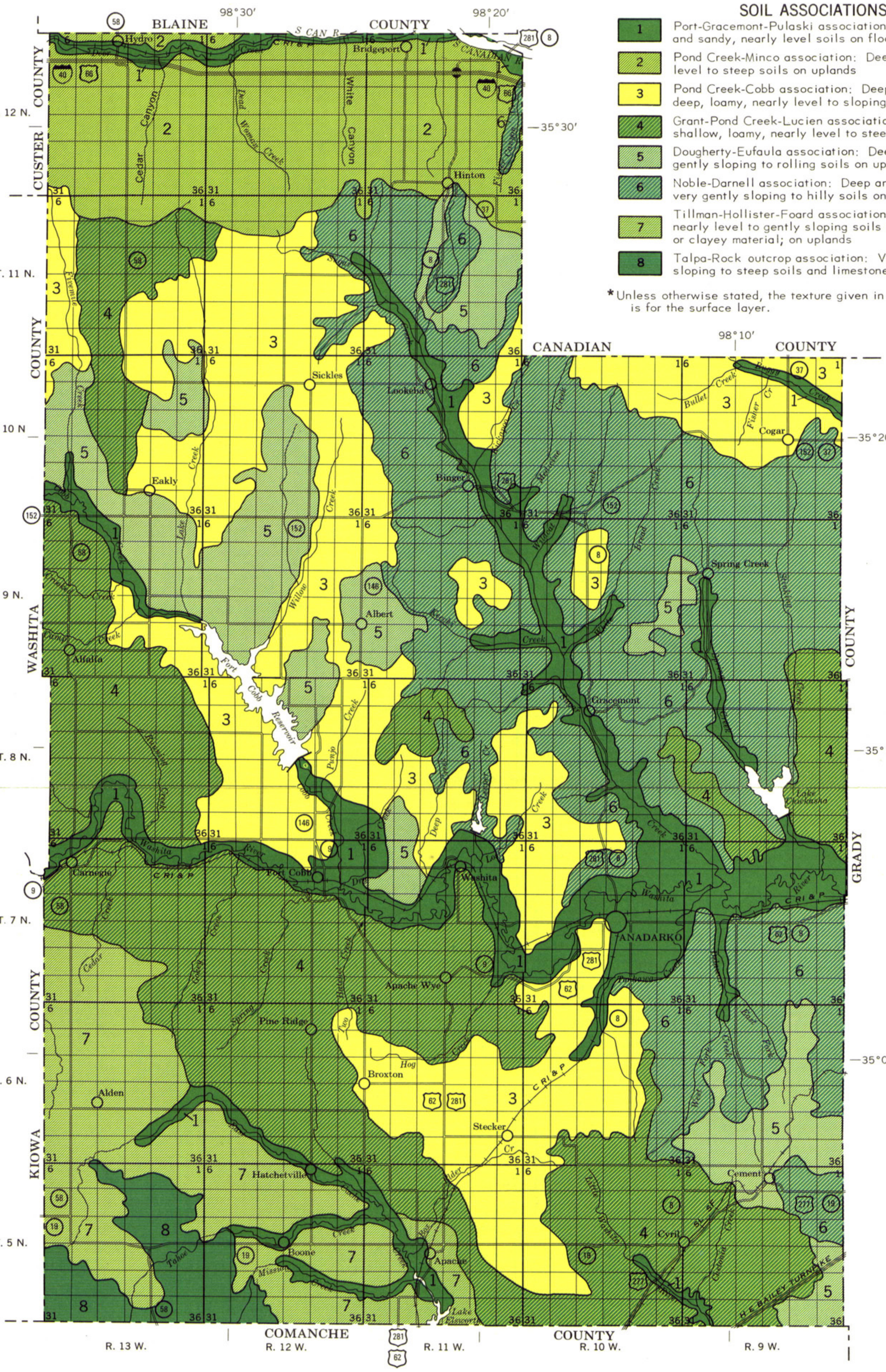
5 Dougherty-Eufaula association: Deep, sandy, very gently sloping to rolling soils on uplands

6 Noble-Darnell association: Deep and shallow, loamy, very gently sloping to hilly soils on uplands

7 Tillman-Hollister-Foard association: Deep, loamy, nearly level to gently sloping soils underlain by loamy or clayey material; on uplands

8 Talpa-Rock outcrop association: Very shallow, loamy, sloping to steep soils and limestone rock on uplands

*Unless otherwise stated, the texture given in descriptive names is for the surface layer.



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

OKLAHOMA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

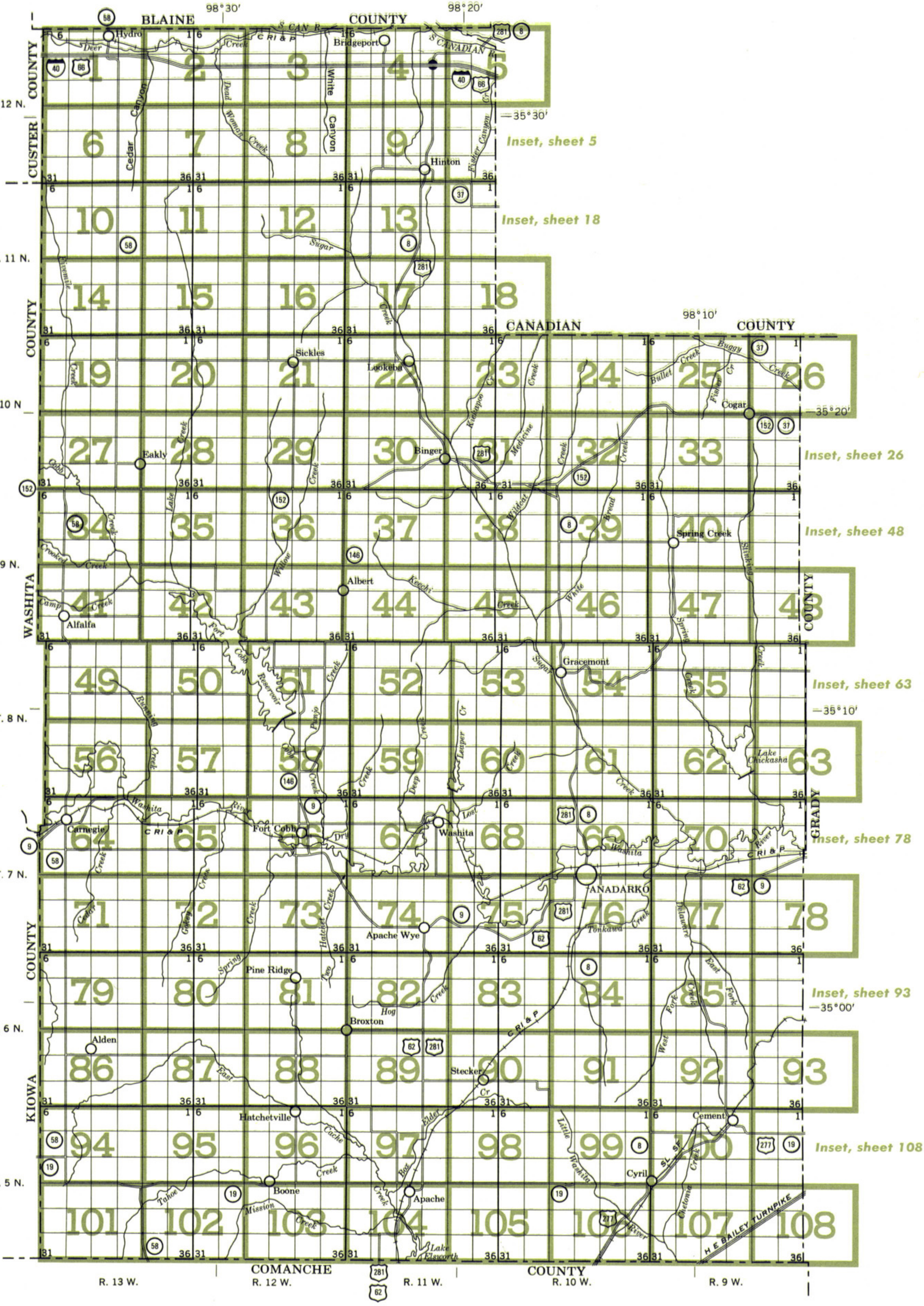
CADDO COUNTY, OKLAHOMA

Scale 1:253,440

1 0 1 2 3 4 Miles

Published 1971

This map is for general planning. It shows only the major soils and does not contain sufficient detail for operational planning.



INDEX TO MAP SHEETS

CADDO COUNTY, OKLAHOMA

Scale 1:253,440

1 0 1 2 3 4 Miles

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, or E, shows the slope. Most symbols without a slope letter are those of soils that are nearly level, but some are for land types that have a considerable range of slope. A final number, 2 or 3, in the symbol shows that the soil is eroded or severely eroded.

SYMBOL	NAME
AgD	Acme-Gypsum outcrop complex, 2 to 8 percent slopes
Bk	Breaks*
CoB	Cobb fine sandy loam, 1 to 3 percent slopes
CoC	Cobb fine sandy loam, 3 to 5 percent slopes
CoD	Cobb fine sandy loam, 5 to 8 percent slopes
CoD2	Cobb fine sandy loam, 3 to 8 percent slopes, eroded
CrD3	Cobb and Grant soils, 3 to 8 percent slopes, severely eroded
Cs	Cyril fine sandy loam
Cy	Cyril fine sandy loam, noncalcareous variant
DaD3	Darnell soils, 3 to 12 percent slopes, severely eroded
DnD	Darnell-Noble association, rolling*
DnE	Darnell-Noble association, hilly*
DoB	Dougherty loamy fine sand, 1 to 3 percent slopes
DuD	Dougherty and Eufaula loamy fine sands, 3 to 8 percent slopes
EfD	Eufaula fine sand, rolling
EuB	Eufaula loamy fine sand, 1 to 3 percent slopes
EuC	Eufaula loamy fine sand, hummocky
FoA	Foard silt loam, 0 to 1 percent slopes
Gm	Gracemont soils
GrB	Grant loam, 1 to 3 percent slopes
GrC	Grant loam, 3 to 5 percent slopes
GrC2	Grant loam, 3 to 6 percent slopes, eroded
GrD	Grant loam, 5 to 8 percent slopes
GwC	Grant-Wing complex, 1 to 5 percent slopes
HoA	Hollister silt loam, 0 to 1 percent slopes
KoC2	Konawa loamy fine sand, 1 to 5 percent slopes, eroded
KsD3	Konawa soils, 2 to 8 percent slopes, severely eroded
Lm	Limestone cobbly land
LuD	Lucien-Dill fine sandy loams, 3 to 12 percent slopes
LuE	Lucien-Dill fine sandy loams, 12 to 30 percent slopes
Mc	McLain silty clay loam
Me	Miller silty clay loam
MoD	Minco very fine sandy loam, 3 to 8 percent slopes
MoE	Minco very fine sandy loam, steep
MsC	Minco silt loam, 3 to 5 percent slopes
NoB	Noble fine sandy loam, 1 to 3 percent slopes
NoD	Noble fine sandy loam, 3 to 8 percent slopes
NrB	Norge silt loam, 1 to 3 percent slopes
NrC	Norge silt loam, 3 to 5 percent slopes
PcA	Pond Creek fine sandy loam, 0 to 1 percent slopes
PcB	Pond Creek fine sandy loam, 1 to 3 percent slopes
PkA	Pond Creek silt loam, 0 to 1 percent slopes
PkB	Pond Creek silt loam, 1 to 3 percent slopes
PkB2	Pond Creek silt loam, 1 to 3 percent slopes, eroded
Po	Port silt loam
Pp	Port and Pulaski soils, channeled
Pu	Pulaski soils
QwD	Quinlan-Woodward complex, 5 to 12 percent slopes
ReA	Reinach silt loam, upland, 0 to 1 percent slopes
ReB	Reinach silt loam, upland, 1 to 3 percent slopes
RhA	Reinach silt loam, 0 to 1 percent slopes
Ro	Rough broken land*
ShB	Shellabarger fine sandy loam, 1 to 3 percent slopes
ShC	Shellabarger fine sandy loam, 3 to 5 percent slopes
TaE	Talpa-Rock outcrop complex, 5 to 30 percent slopes
TlB	Tillman silty clay loam, 1 to 3 percent slopes
TlC	Tillman silty clay loam, 3 to 5 percent slopes
TlC2	Tillman silty clay loam, 2 to 5 percent slopes, eroded
VeD	Vernon soils, 5 to 12 percent slopes
WuC	Woodward-Quinlan complex, 3 to 5 percent slopes
Ya	Yahola soils

*Low intensity mapping units are marked with an asterisk. The composition of these units is more variable than that of the others in the county but has been controlled well enough to interpret for the expected use of the soils concerned.

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Tunnel

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

BOUNDARIES

- National or state
- County
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
- Unclassified

Canals and ditches (CANAL)

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Alluvial fan

Drainage end

RELIEF

Escarpments
- Bedrock
- Other

Prominent peak

Depressions (Large, Small)
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness: Stony; Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Saline spot

FORT COBB RESERVOIR AND SPRING CREEK RESERVOIR

Fort Cobb Reservoir and Spring Creek Reservoir are major flood control reservoirs located within the county. Normal pool area of each reservoir is overprinted with black fine dots. Area subject to periodic flood control inundation of each reservoir is overprinted with black fine-diagonal lines. Normal pool shoreline is shown as a black fine-weight line. Maximum pool shoreline is shown as a black medium-weight dashed line.

Fort Cobb Reservoir normal pool shoreline is delineated at elevation of water surface as appearing on the 1961 aerial photobase, at a lower level than the designed pool elevation of 1,342 feet; and, its flood control maximum pool shoreline is delineated at elevation of 1,352 feet.

Spring Creek Reservoir normal pool shoreline is delineated at elevation of 1,170 feet; and, its flood control maximum pool shoreline is delineated at elevation of 1,200 feet.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 196_ aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 1

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 10

N

Scale 1:20 000

1 Mile — 5 000 Feet

0 — ¼ — ½ — ¾ — 1

0 — 1 000 — 2 000 — 3 000 — 4 000 — 5 000

CADDO COUNTY, OKLAHOMA NO. 10

Land division corners are approximate and based on the Oklahoma coordinate system, south zone.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

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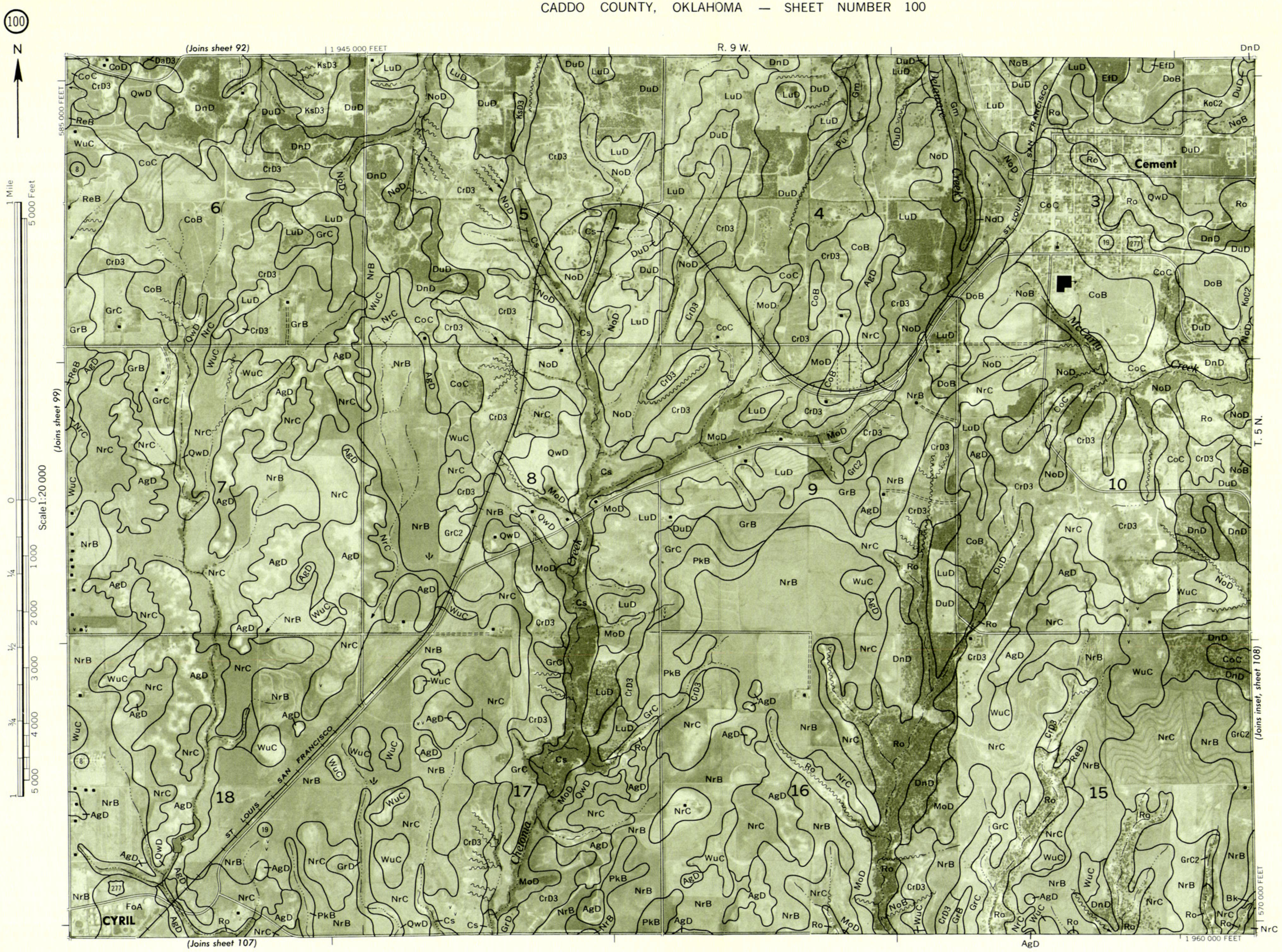
CADDO COUNTY, OKLAHOMA — SHEET NUMBER 100



CADDO COUNTY, OKLAHOMA NO. 100

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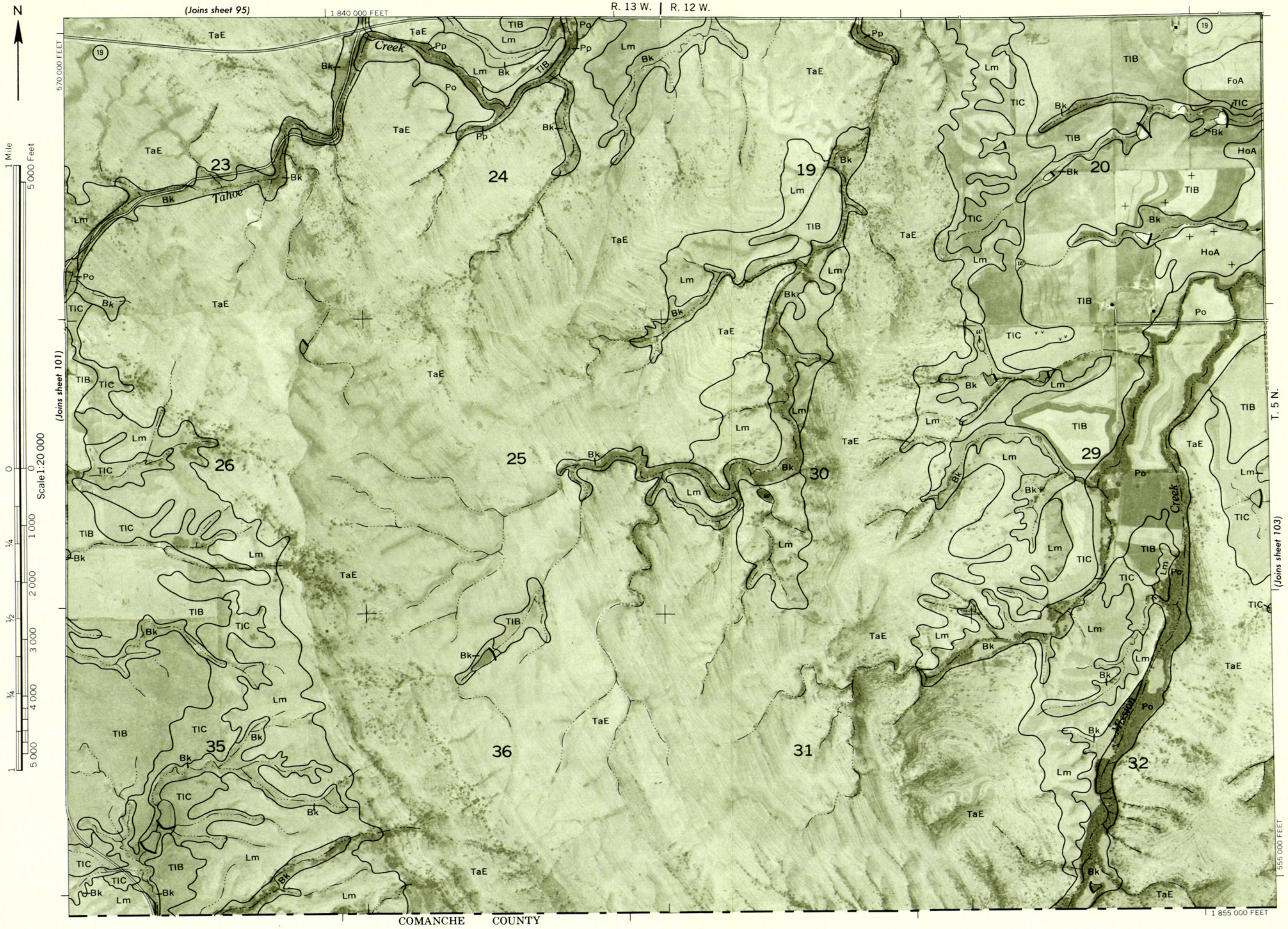
CADDO COUNTY, OKLAHOMA NO. 101



CADDO COUNTY, OKLAHOMA NO. 102

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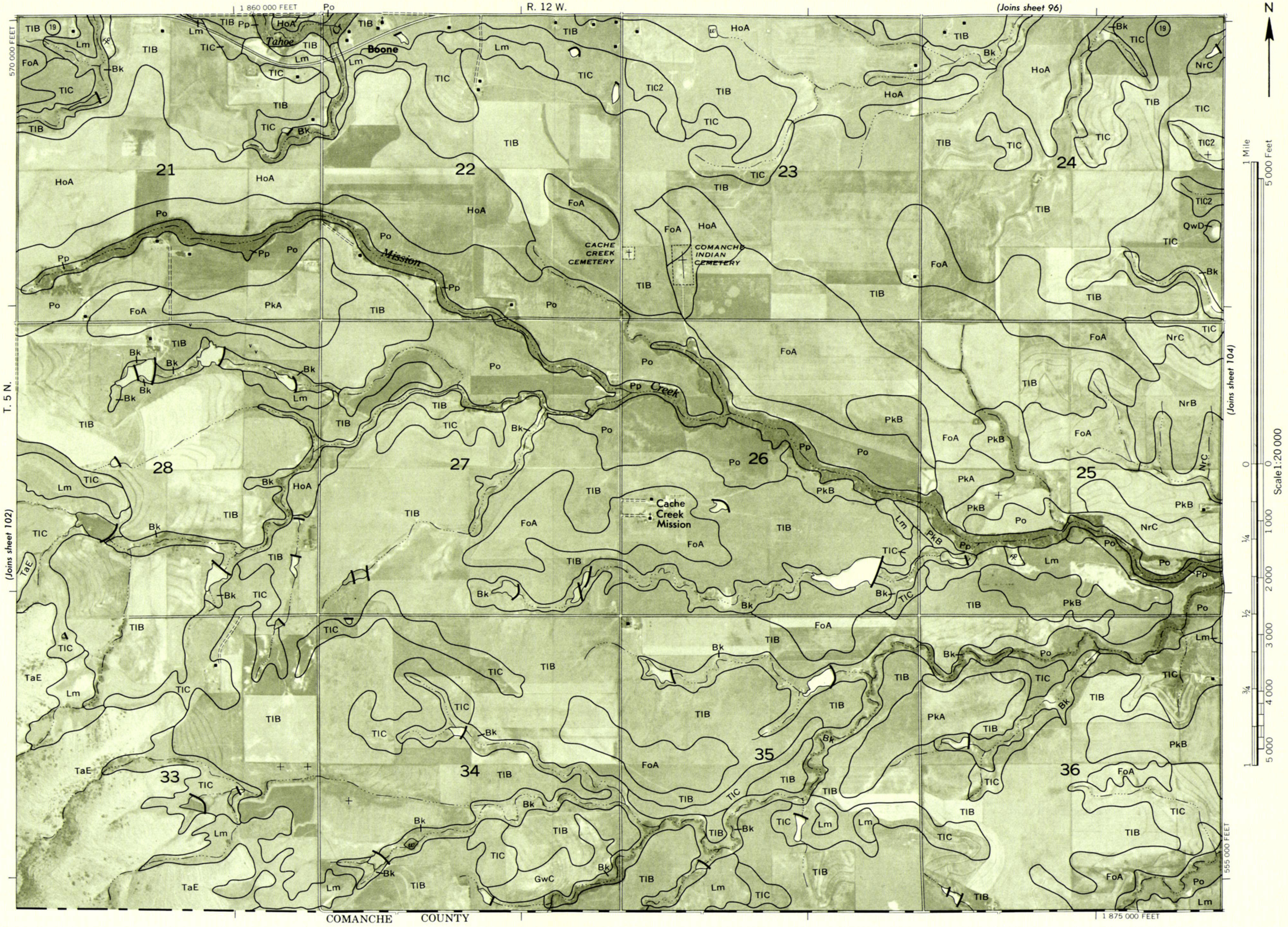

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CADDO COUNTY, OKLAHOMA NO. 104

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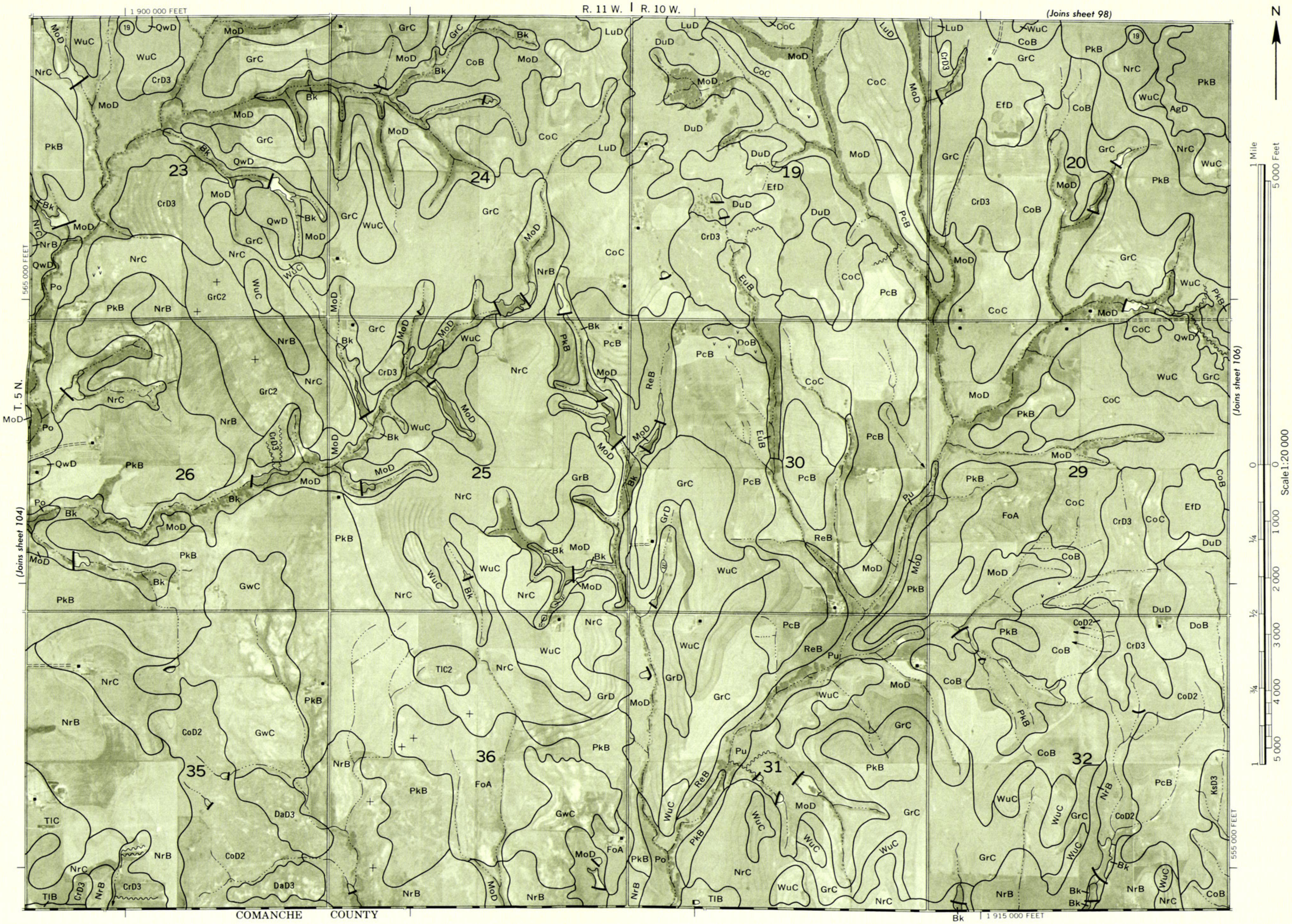
This map is one of [illegible]eet compiled in 19[illegible] as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Okl[illegible]oma Agricultural [illegible]periment Station.



This map is one of a set compiled in 197 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklah a Agricultural E iment Station.
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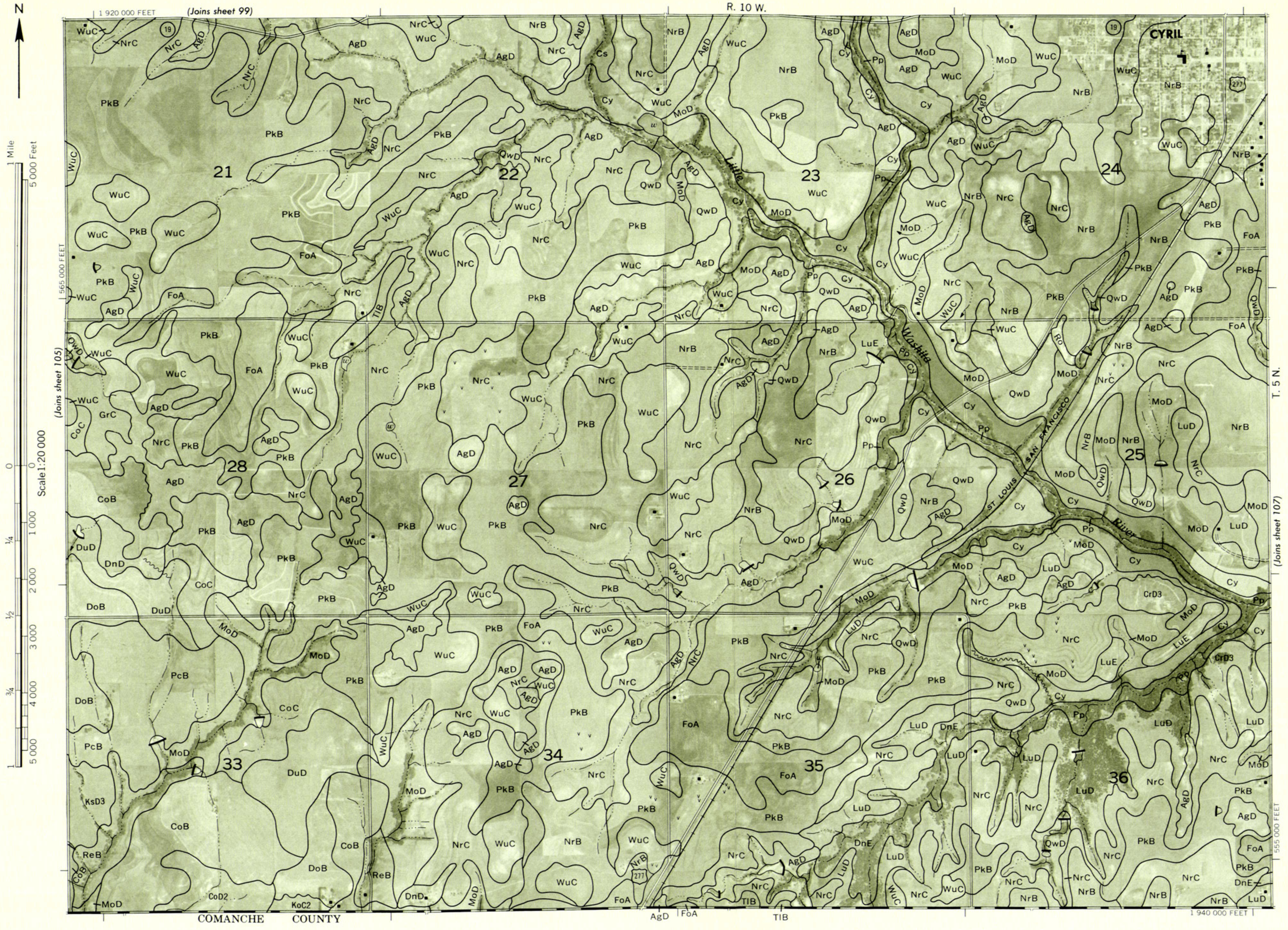
CADDO COUNTY, OKLAHOMA NO. 105

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 106



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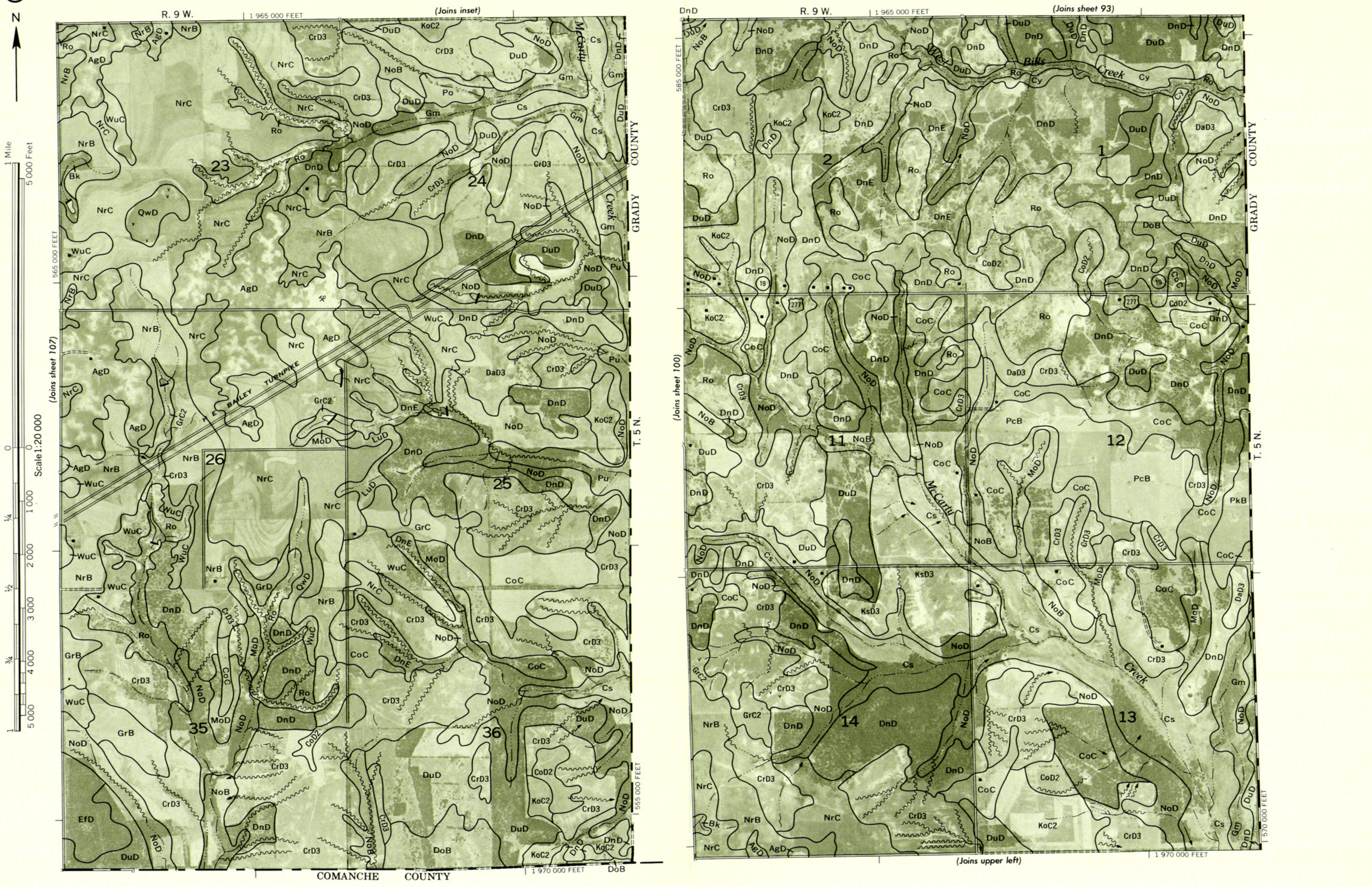
CADDO COUNTY, OKLAHOMA NO. 107

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 108



CADDO COUNTY, OKLAHOMA NO. 108

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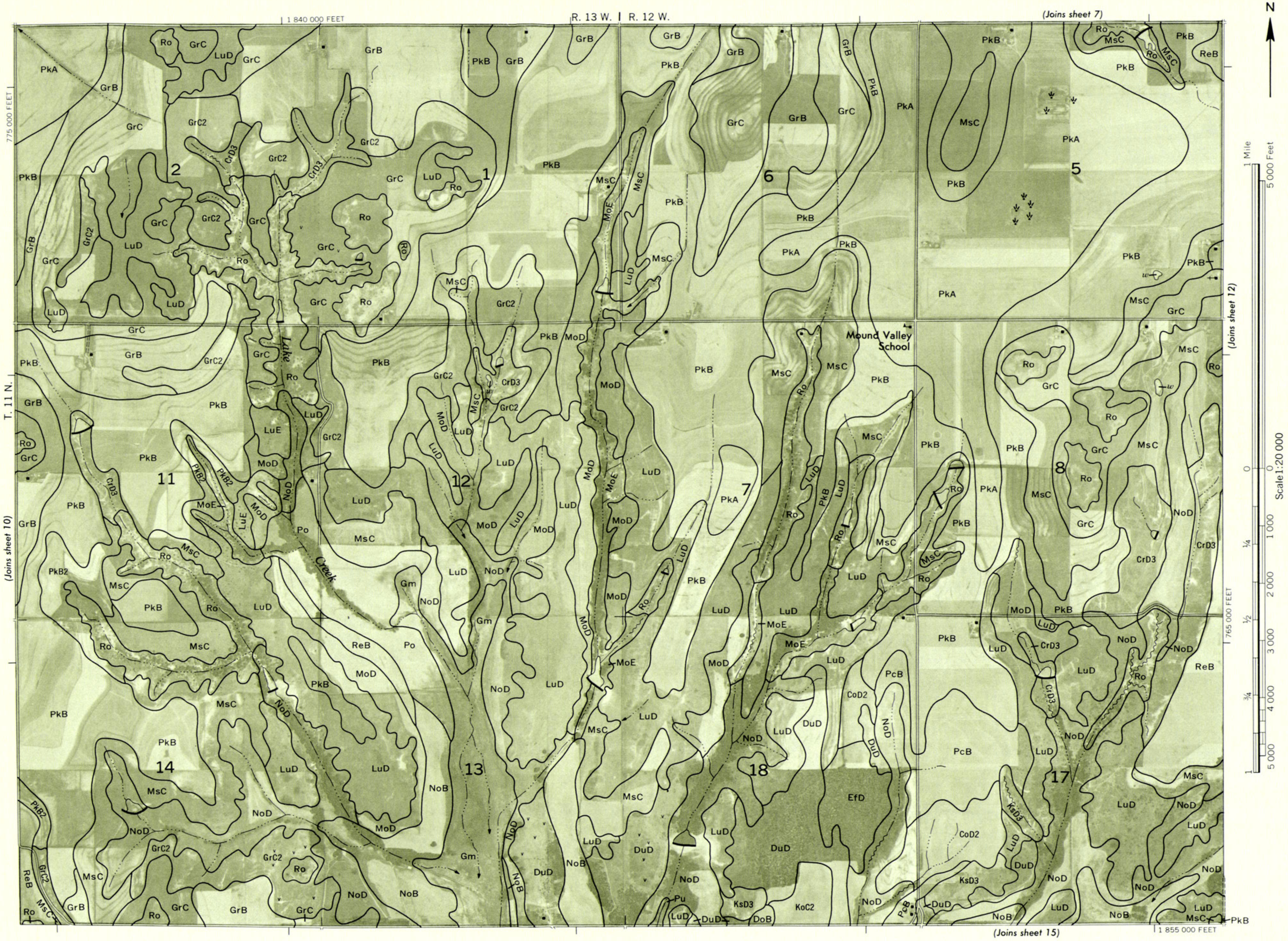

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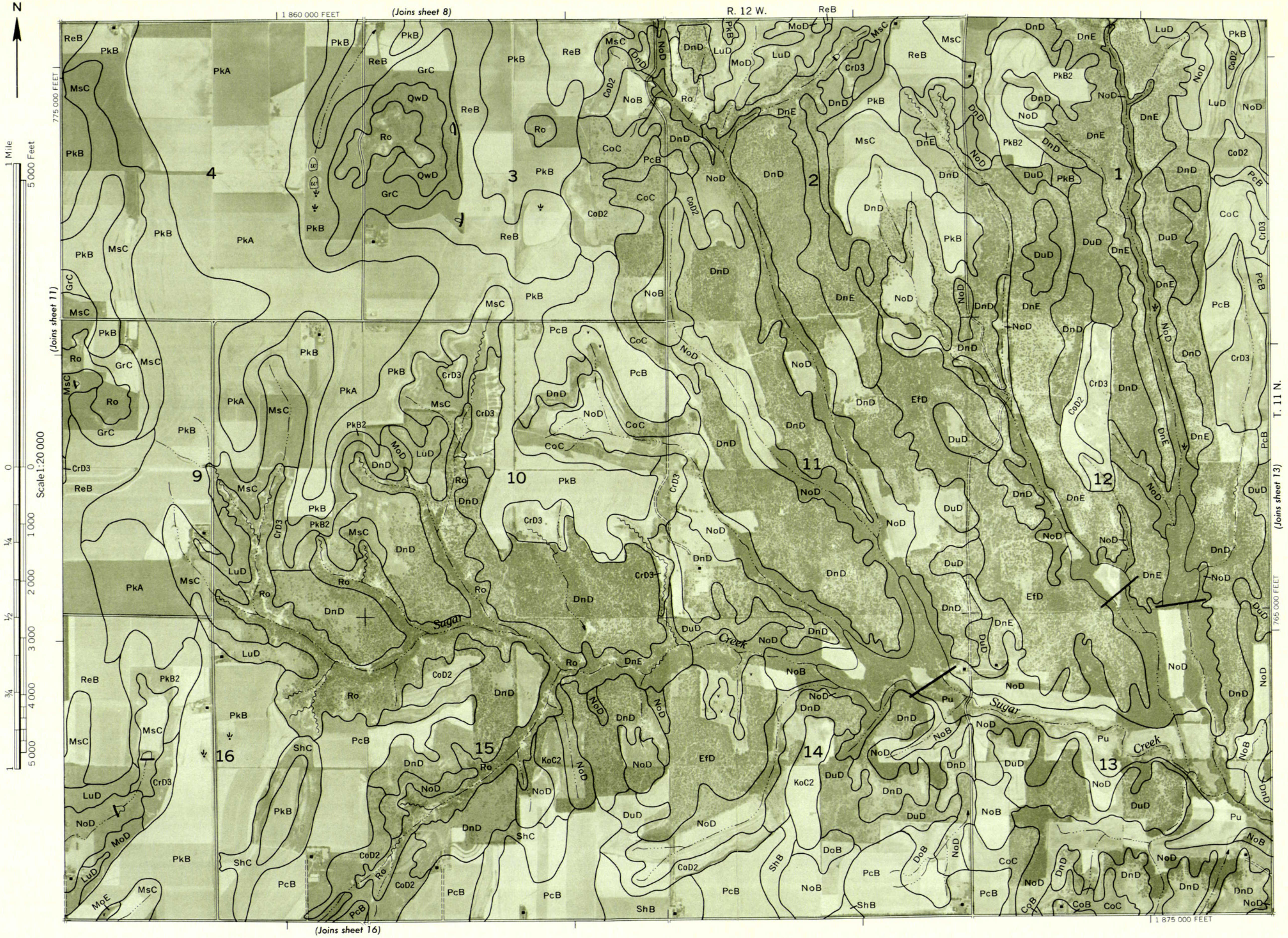

CADDO COUNTY, OKLAHOMA NO. 12

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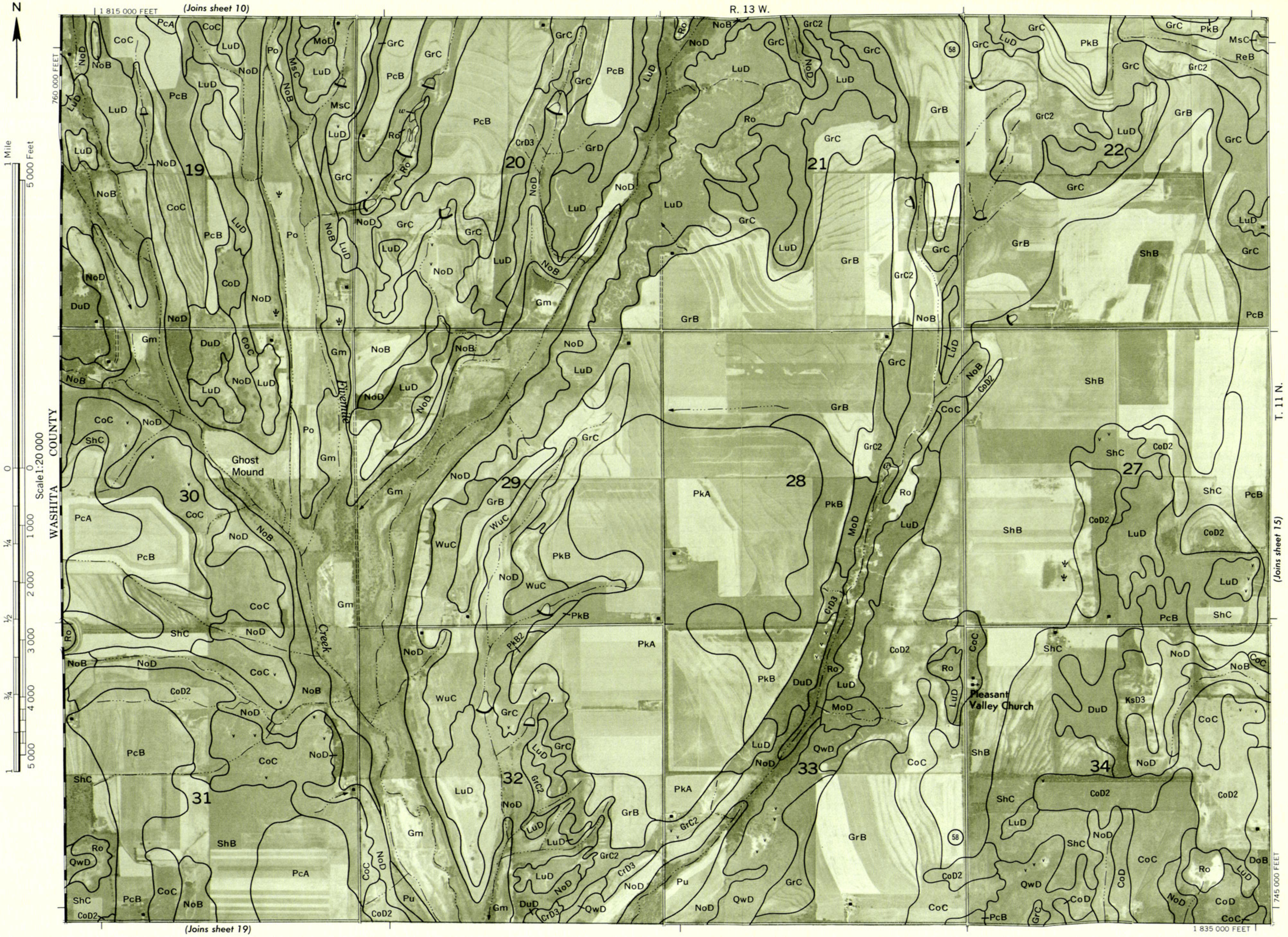
CADDO COUNTY, OKLAHOMA NO. 13

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 14



CADDO COUNTY, OKLAHOMA NO. 14

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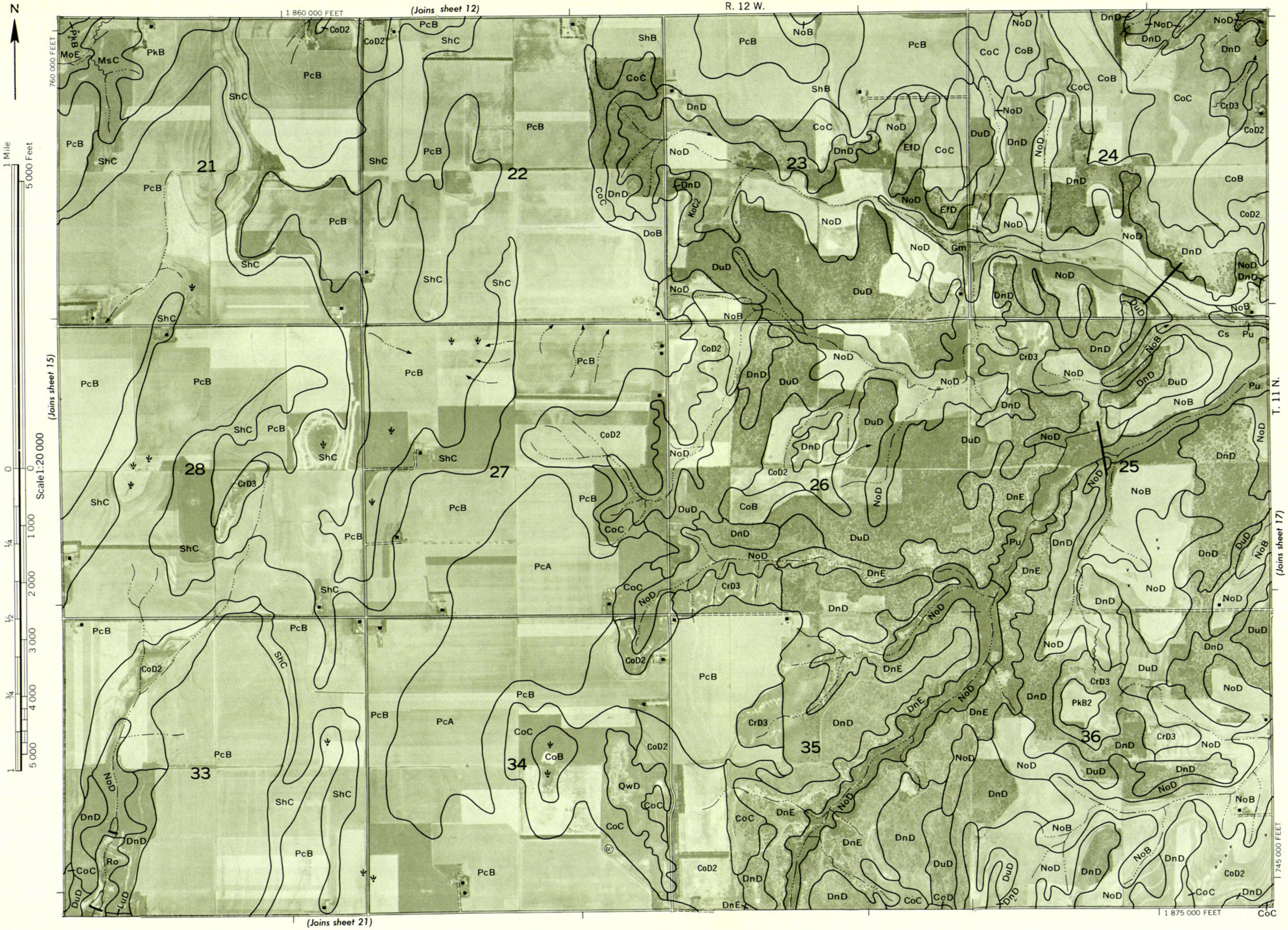
CADDO COUNTY, OKLAHOMA NO. 15



CADDO COUNTY, OKLAHOMA NO. 16

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Land division corners are approximately positioned on this map.

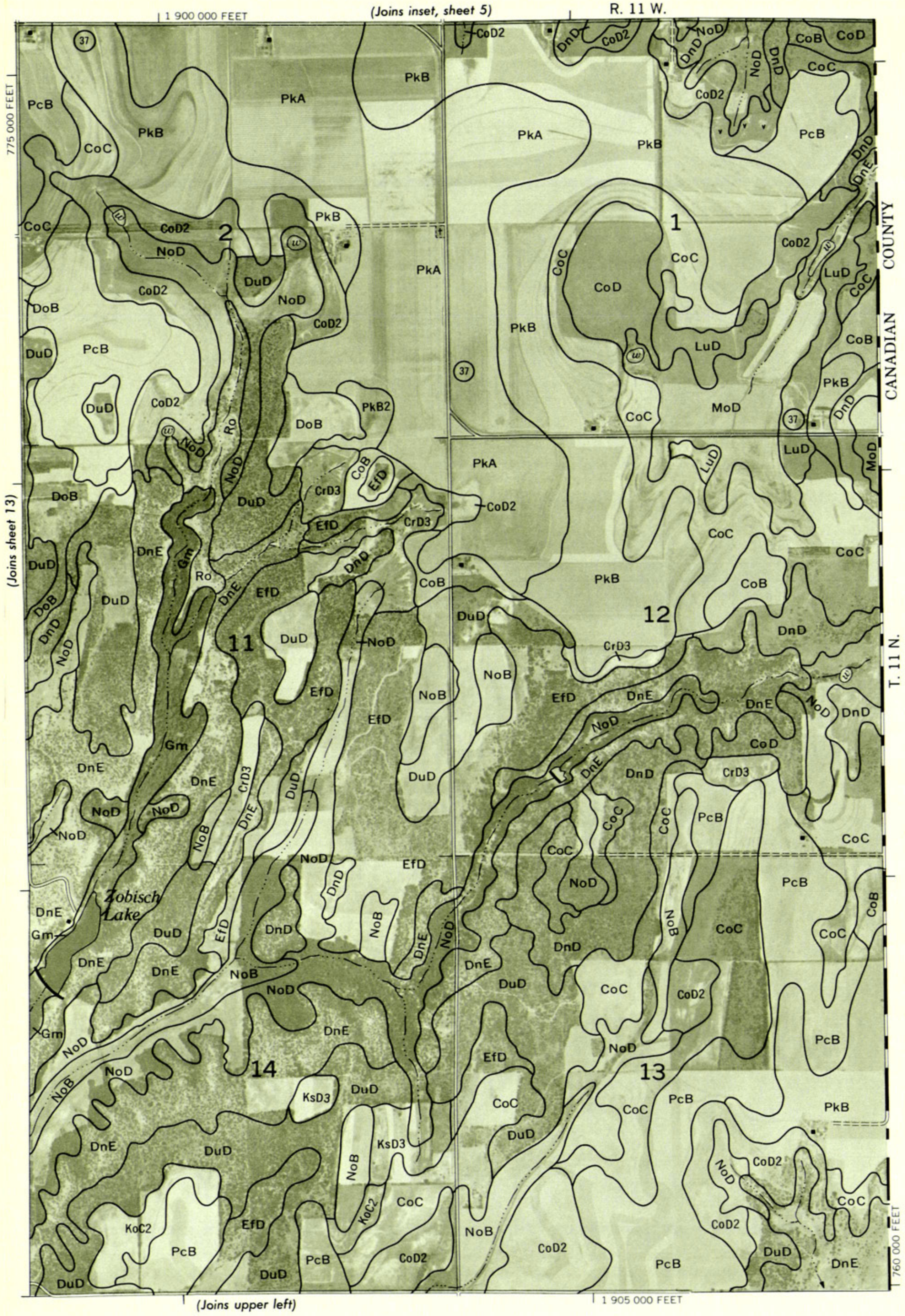
CADDO COUNTY, OKLAHOMA — SHEET NUMBER 18

N

1 Mile 0 ¼ ½ ¾ 1

5 000 Feet 0 1 000 2 000 3 000 4 000 5 000

Scale 1:20 000



CADDO COUNTY, OKLAHOMA NO. 18

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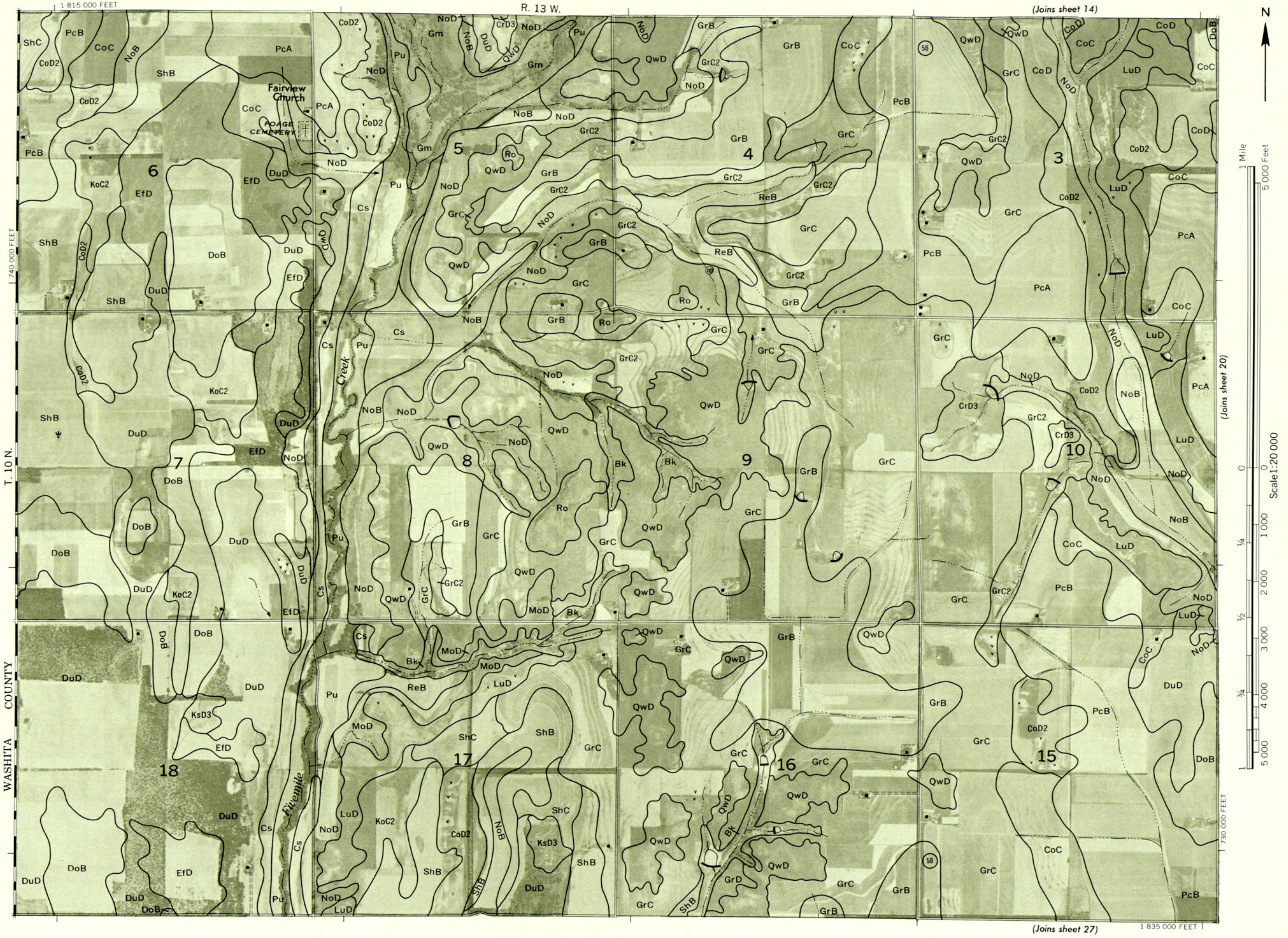

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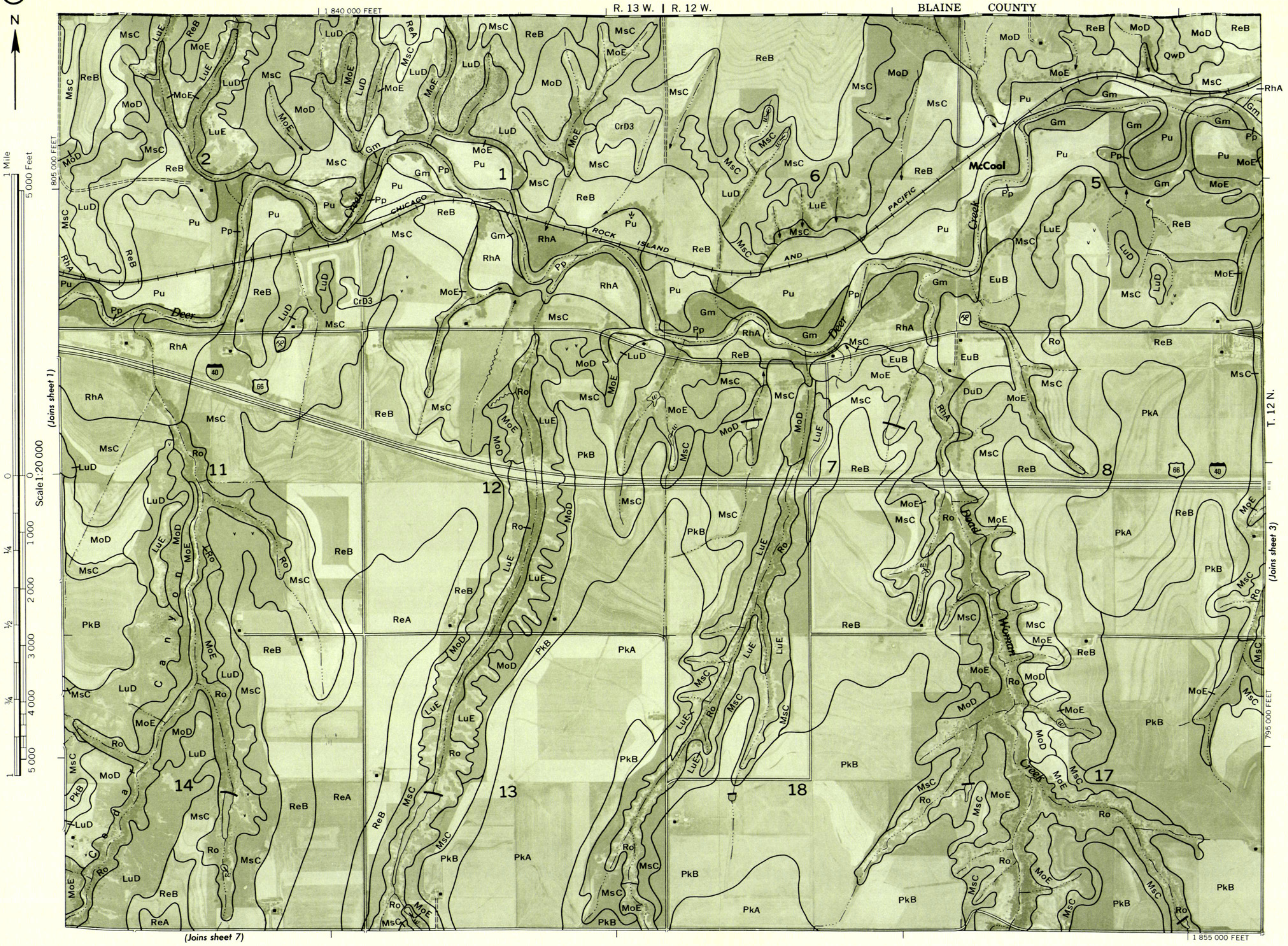
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 19

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 2



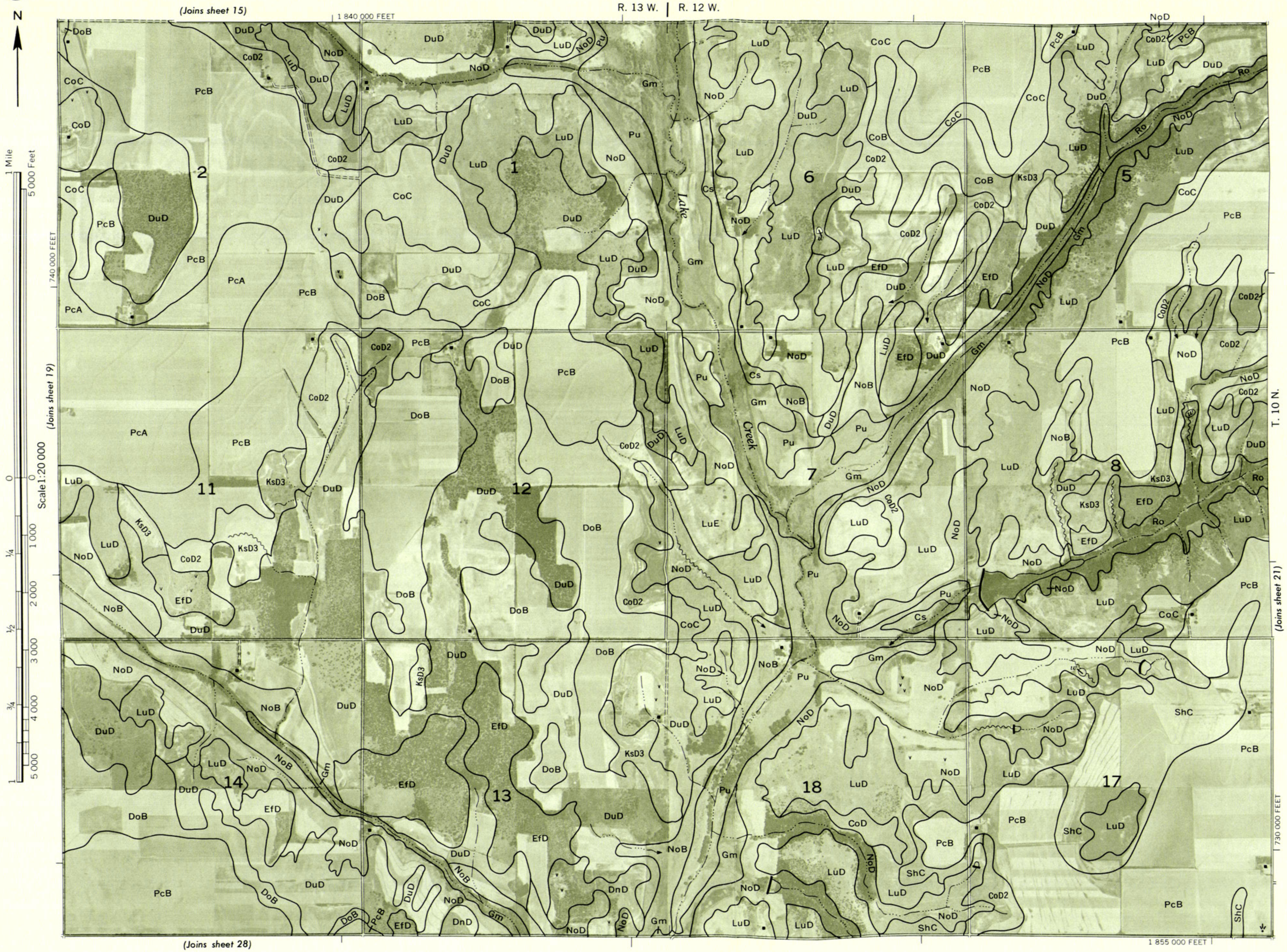
CADDO COUNTY, OKLAHOMA NO. 2

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 20



CADDO COUNTY, OKLAHOMA NO. 20

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 21

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 22

CADDO COUNTY, OKLAHOMA NO. 22

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 23

23

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 23

CADDO COUNTY, OKLAHOMA NO. 24

Land division corners are approximately positioned on this map.

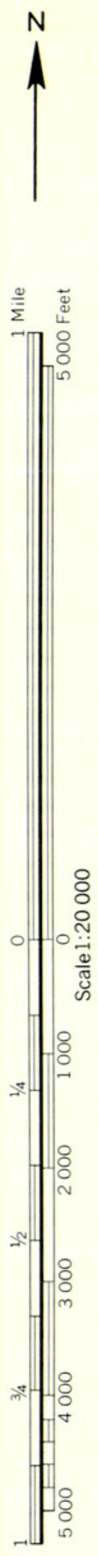
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

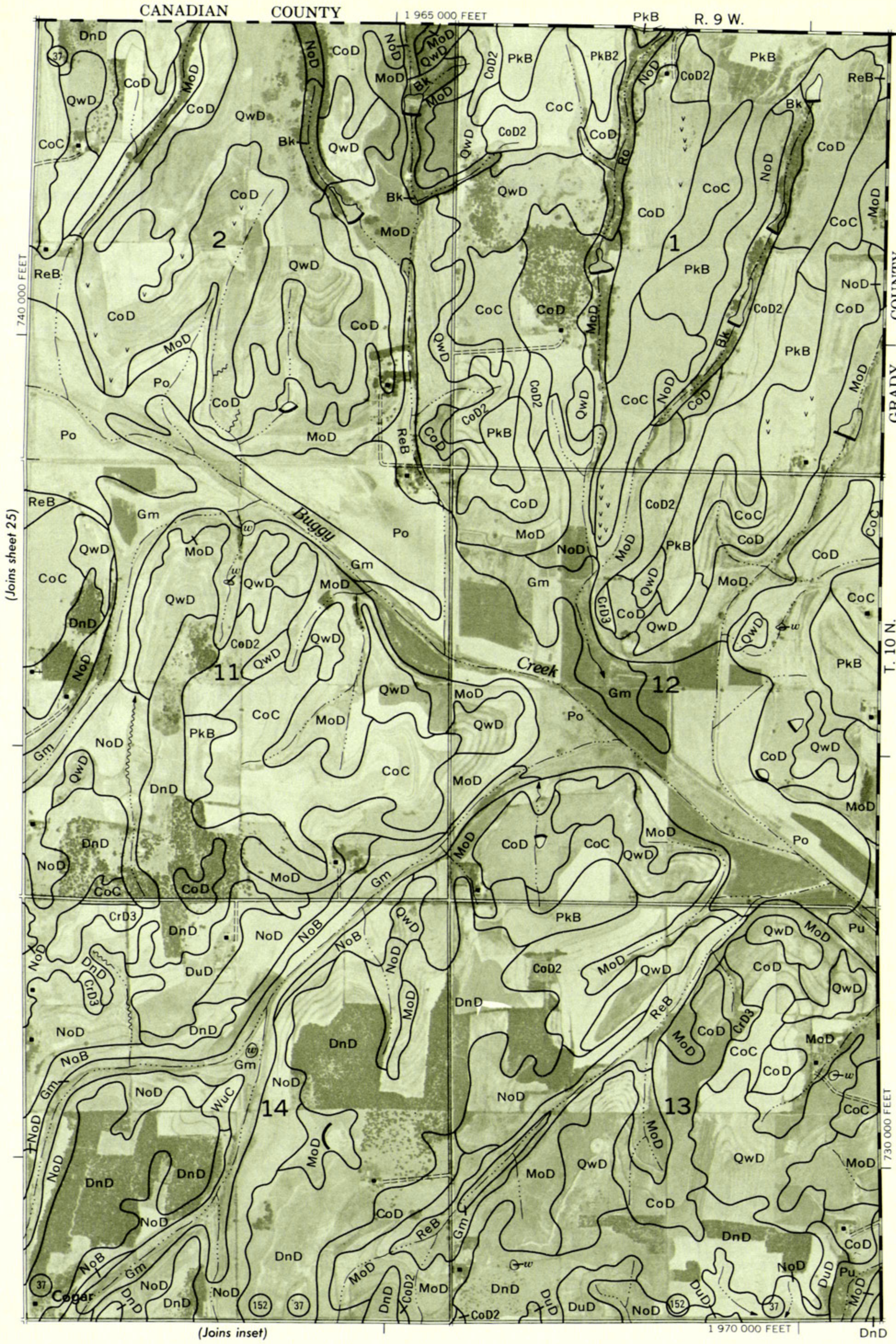
This map is one of a set compiled in 197 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

25

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 25



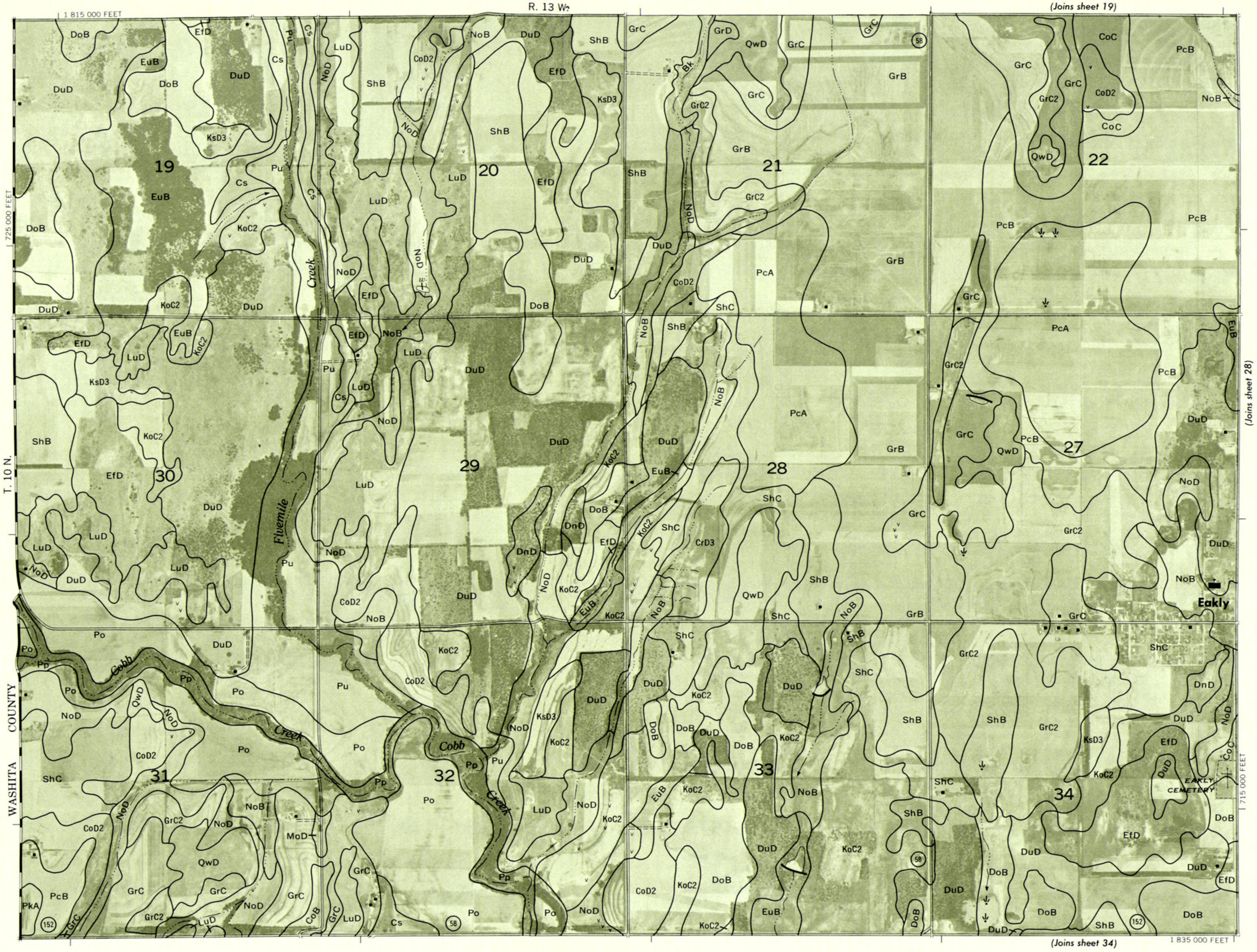


CADDO COUNTY, OKLAHOMA NO. 26

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

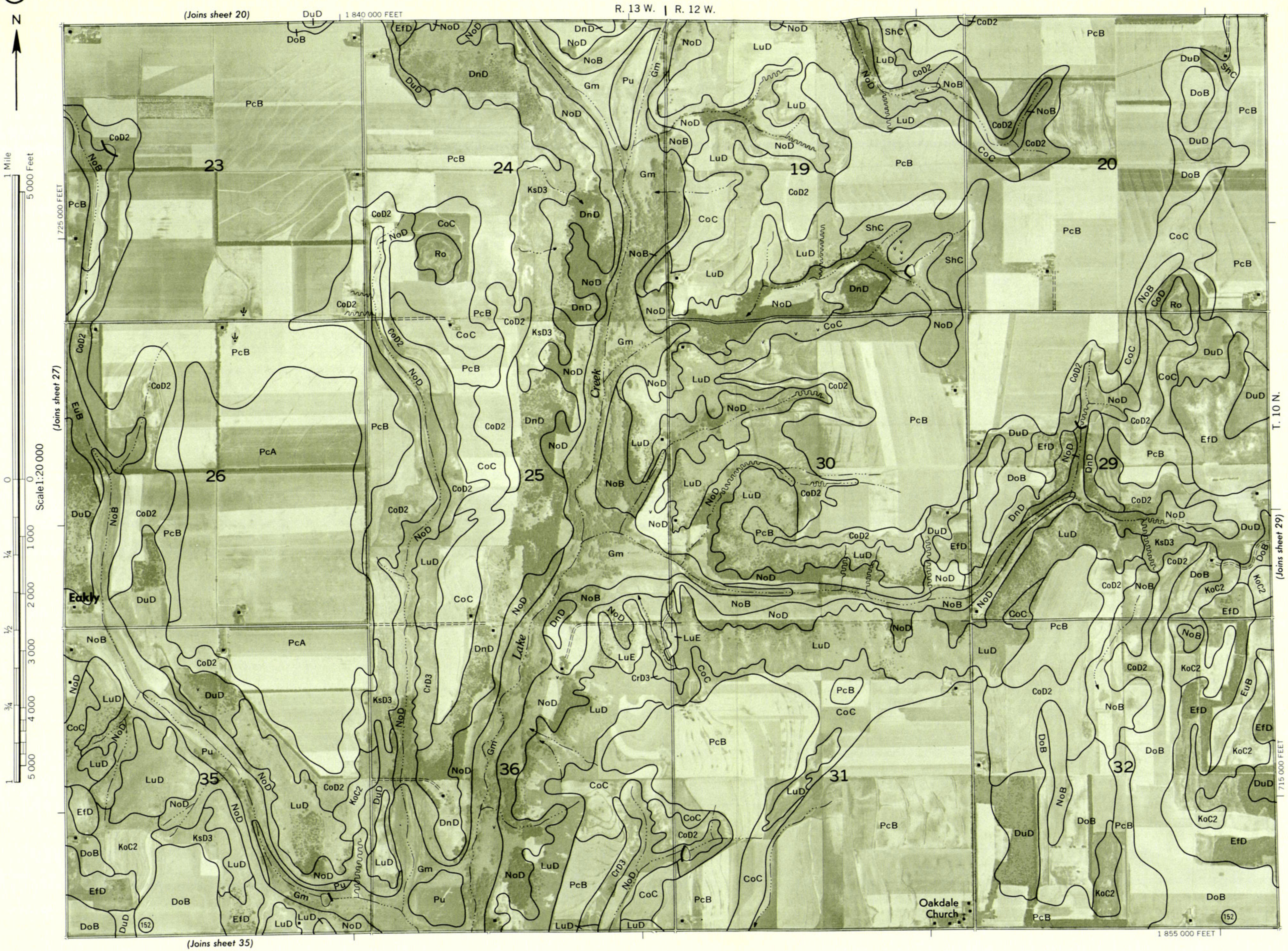
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.



This map is one of a set compiled in 197-, as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 27

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 28



CADDO COUNTY, OKLAHOMA NO. 28

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

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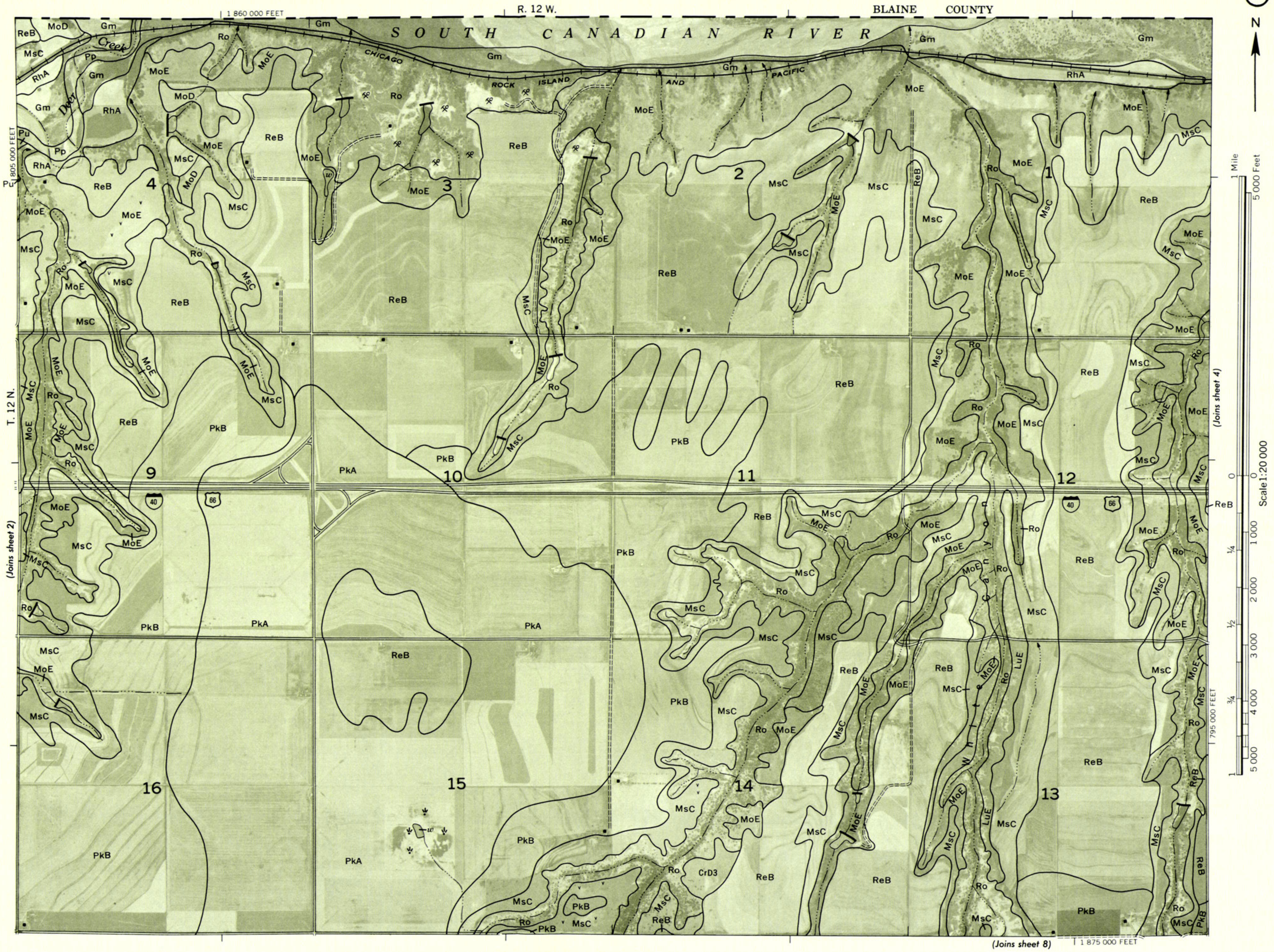
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 29



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 3

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 30

CADDO COUNTY, OKLAHOMA NO. 30

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

This map is one of a set compiled in 1977 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 31

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 32

CADDO COUNTY, OKLAHOMA NO. 32

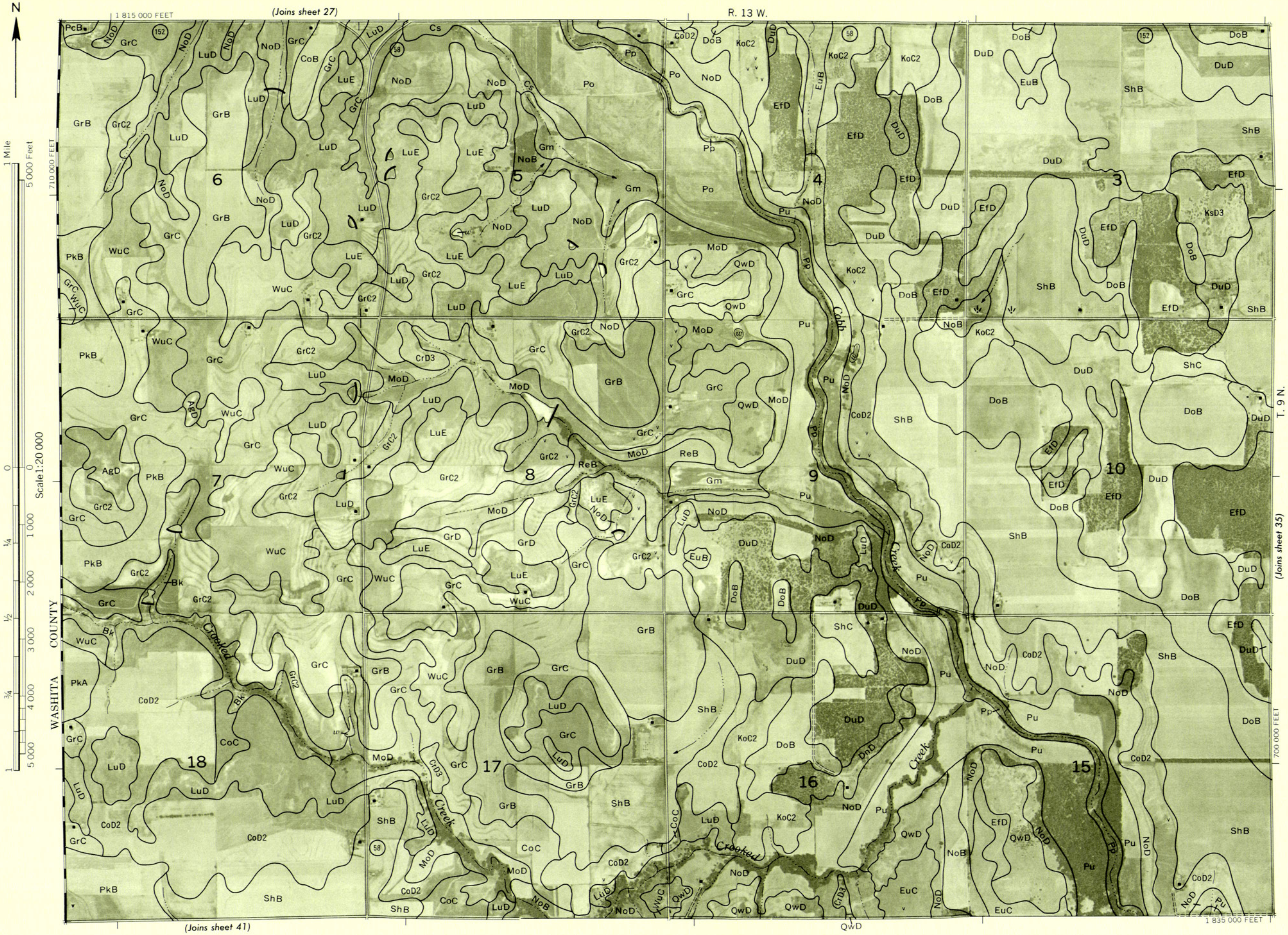
Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 197[illegible] as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.
CADDO COUNTY, OKLAHOMA NO. 33

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 34

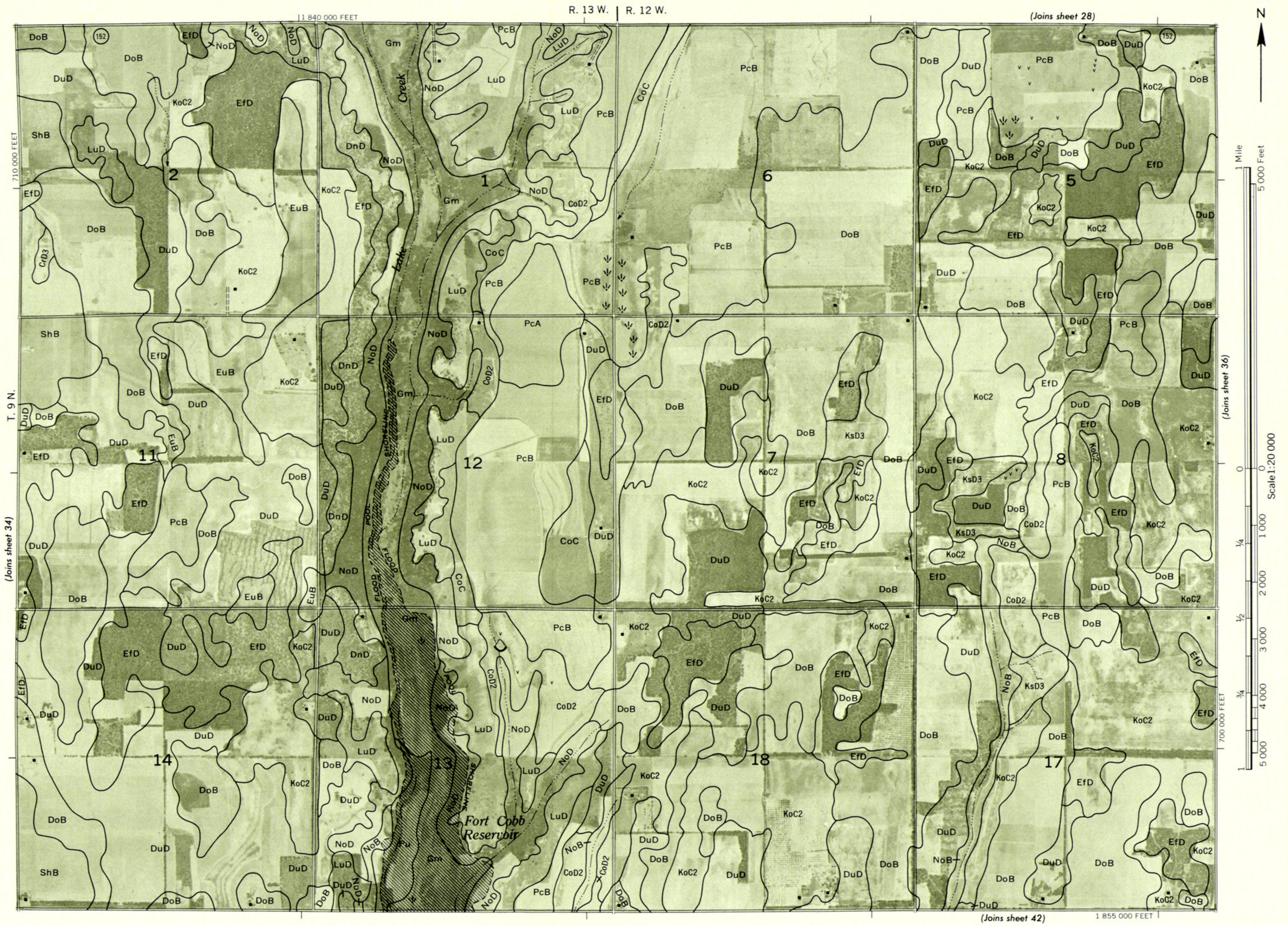


CADDO COUNTY, OKLAHOMA NO. 34

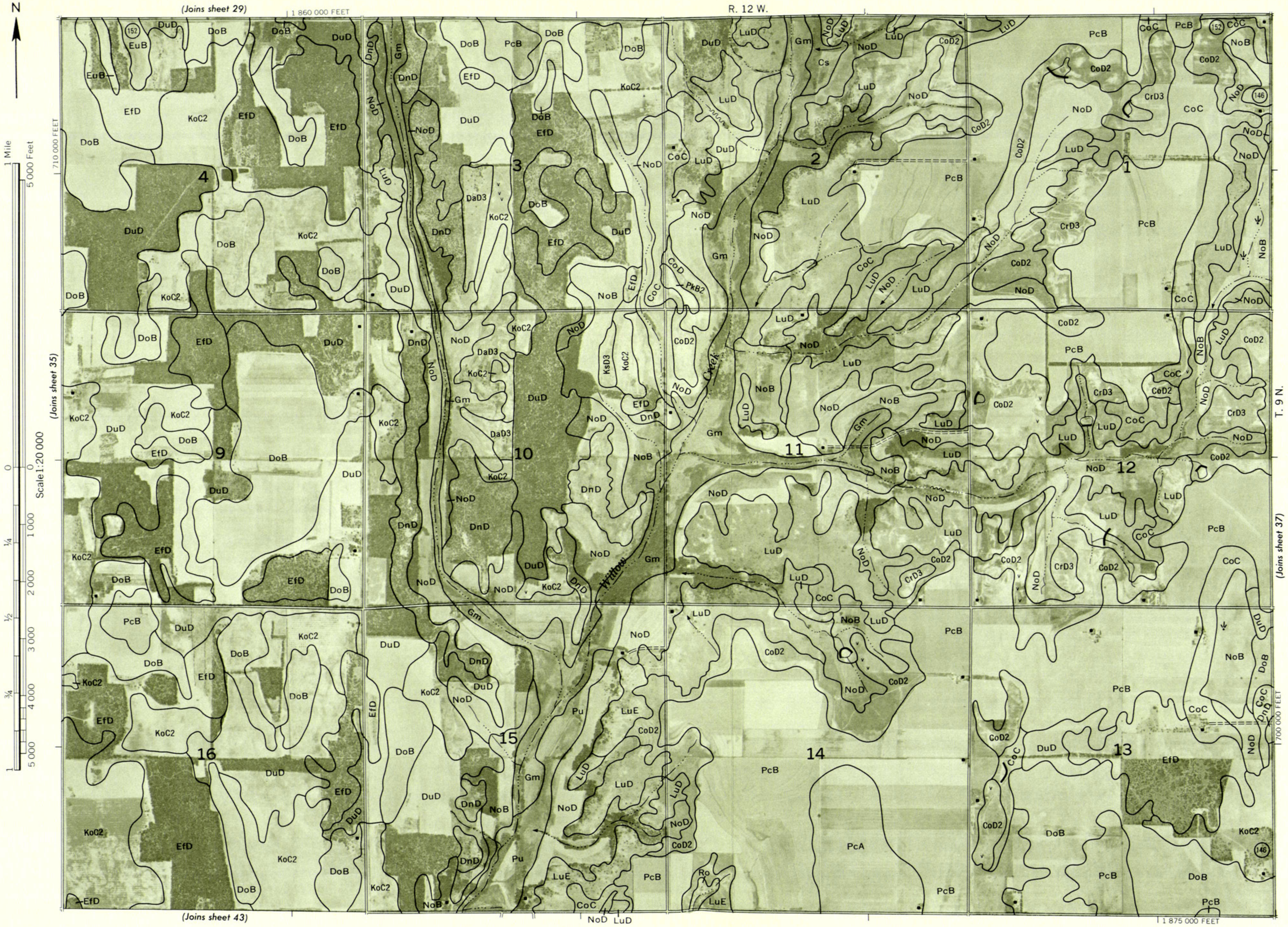
Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.



This map is one of a set compiled in 197[illegible] as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

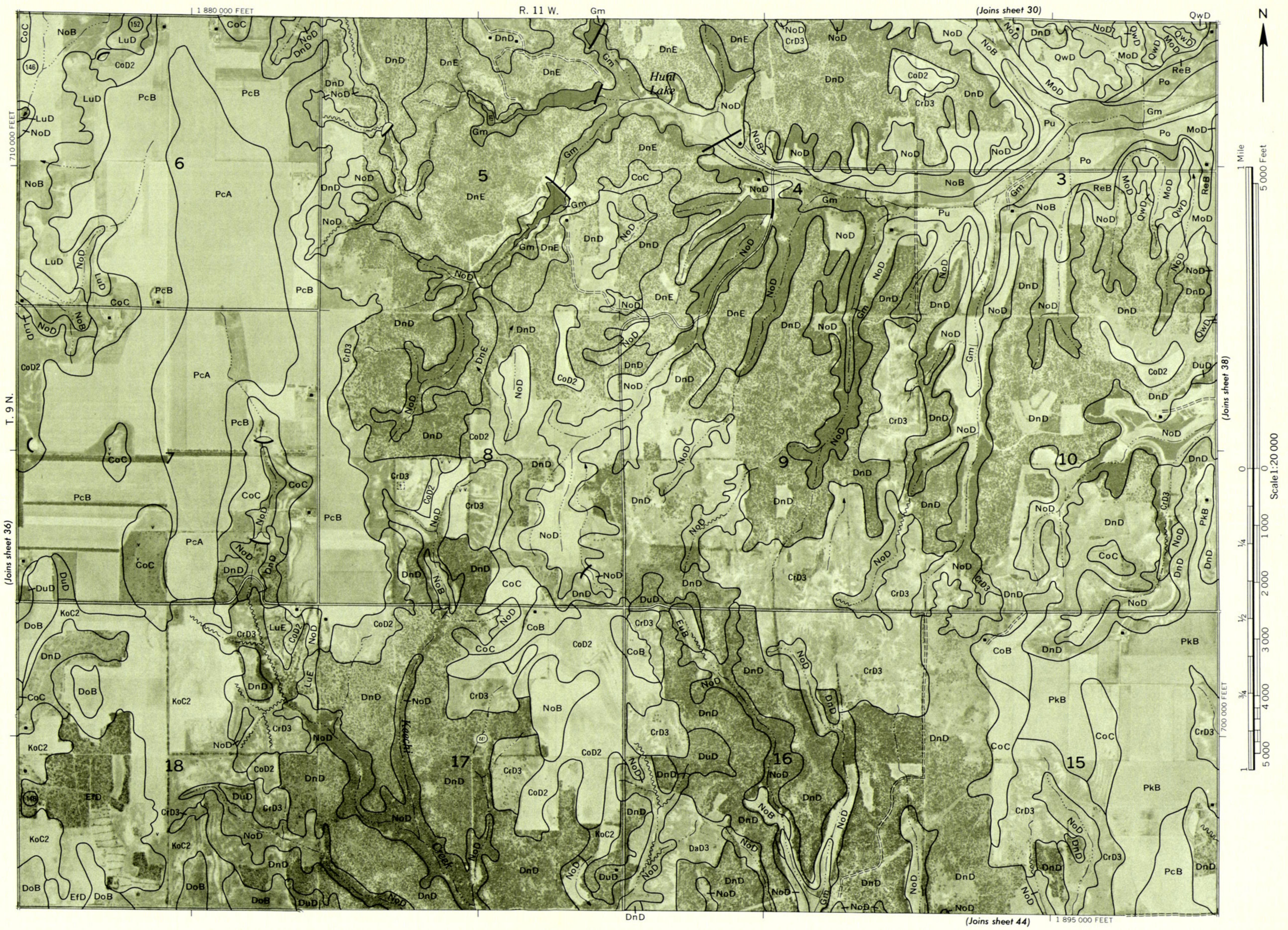


CADDO COUNTY, OKLAHOMA NO. 36

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 197_ as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.
CADDO COUNTY, OKLAHOMA NO. 37

CADDO COUNTY, OKLAHOMA NO. 38

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 197_ as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

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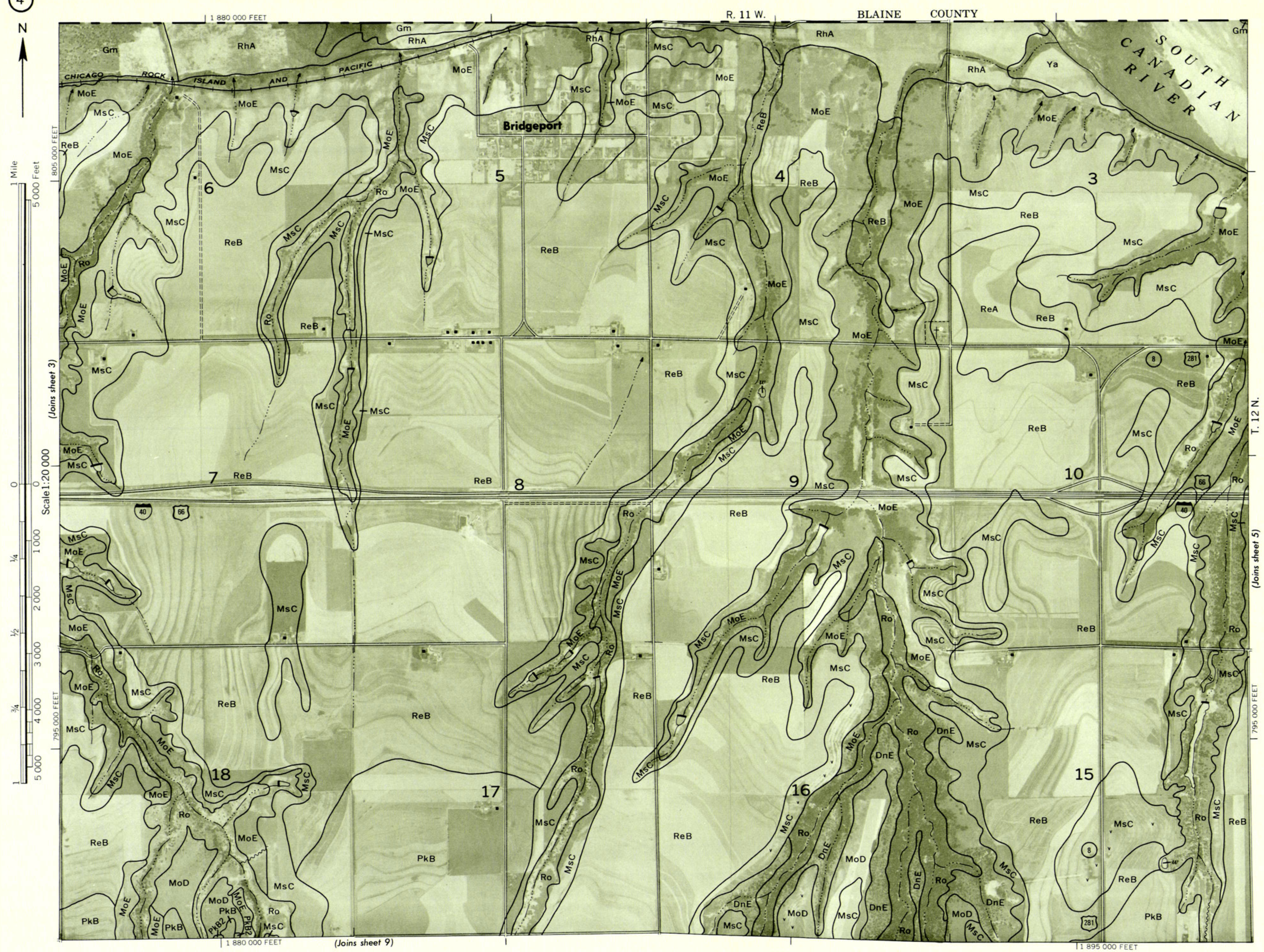
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.
CADDO COUNTY, OKLAHOMA NO. 39

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 4



CADDO COUNTY, OKLAHOMA NO. 4

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 40

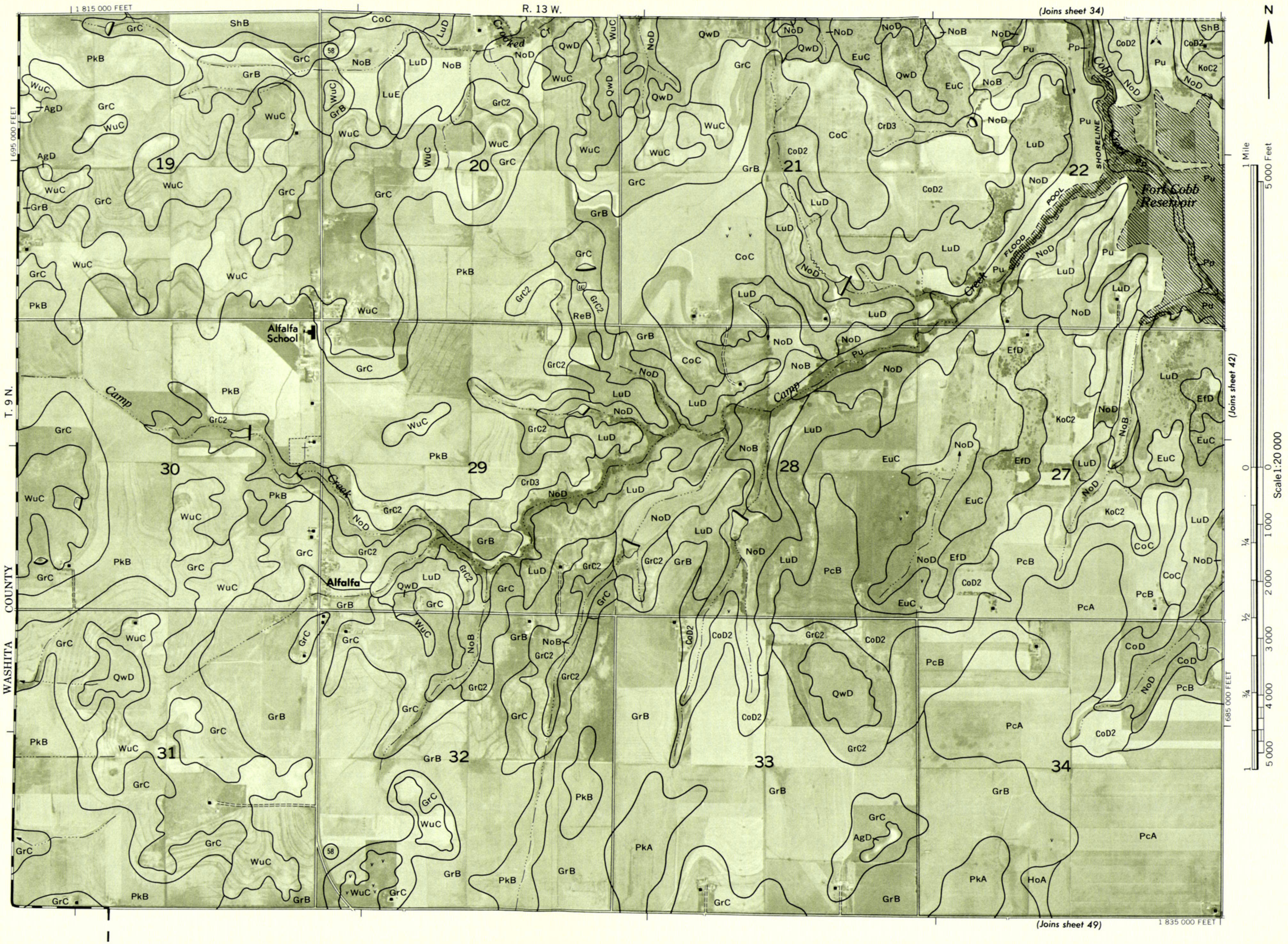
CADDO COUNTY, OKLAHOMA NO. 40

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

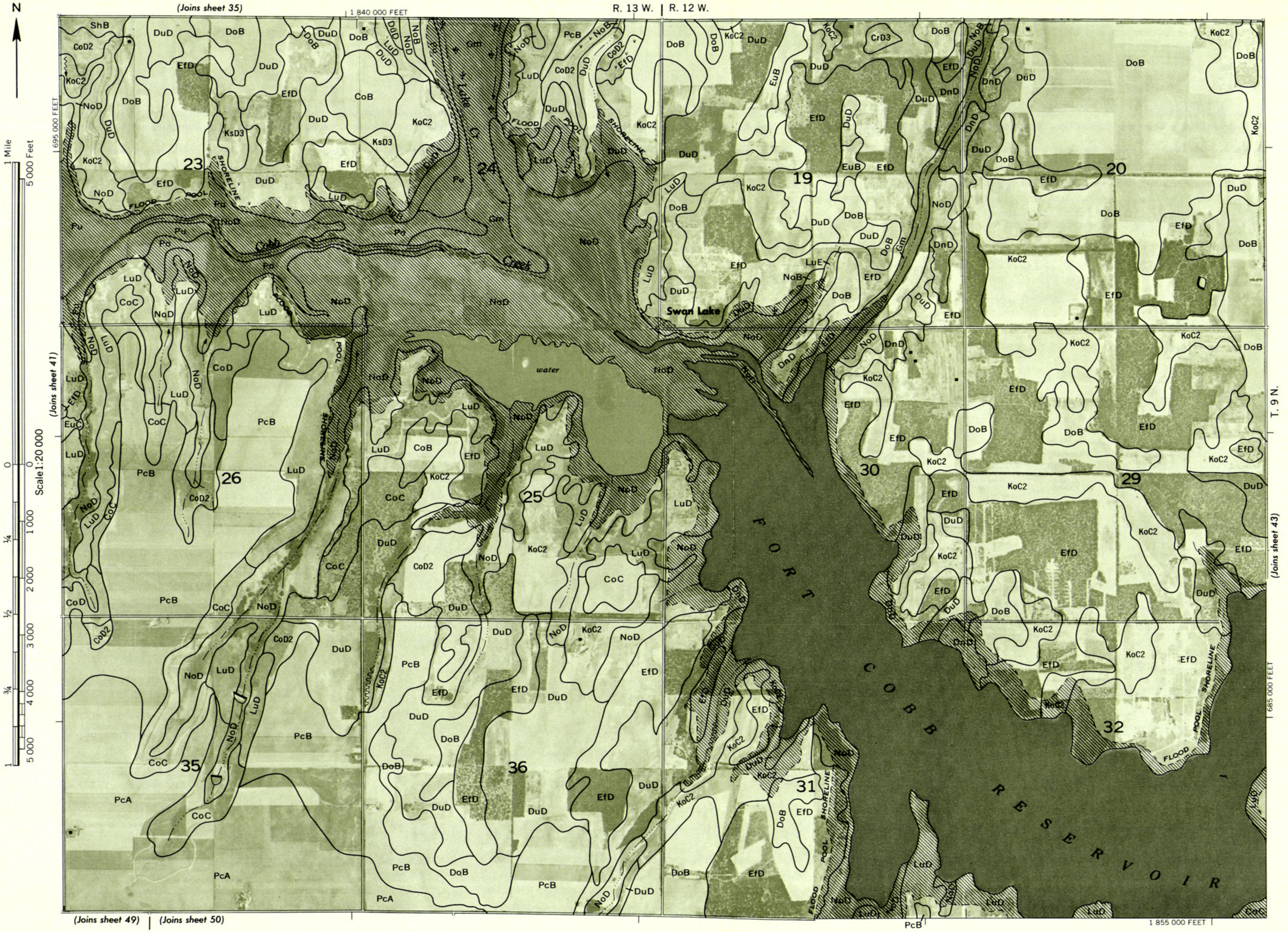
This map is one of a set compiled in 197 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

41



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 41



CADDO COUNTY, OKLAHOMA NO. 42

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

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Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 43

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 44

CADDO COUNTY, OKLAHOMA NO. 44

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 197_, as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

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Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 45

45

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 46

CADDO COUNTY, OKLAHOMA NO. 46

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 47

CADDO COUNTY, OKLAHOMA NO. 48

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

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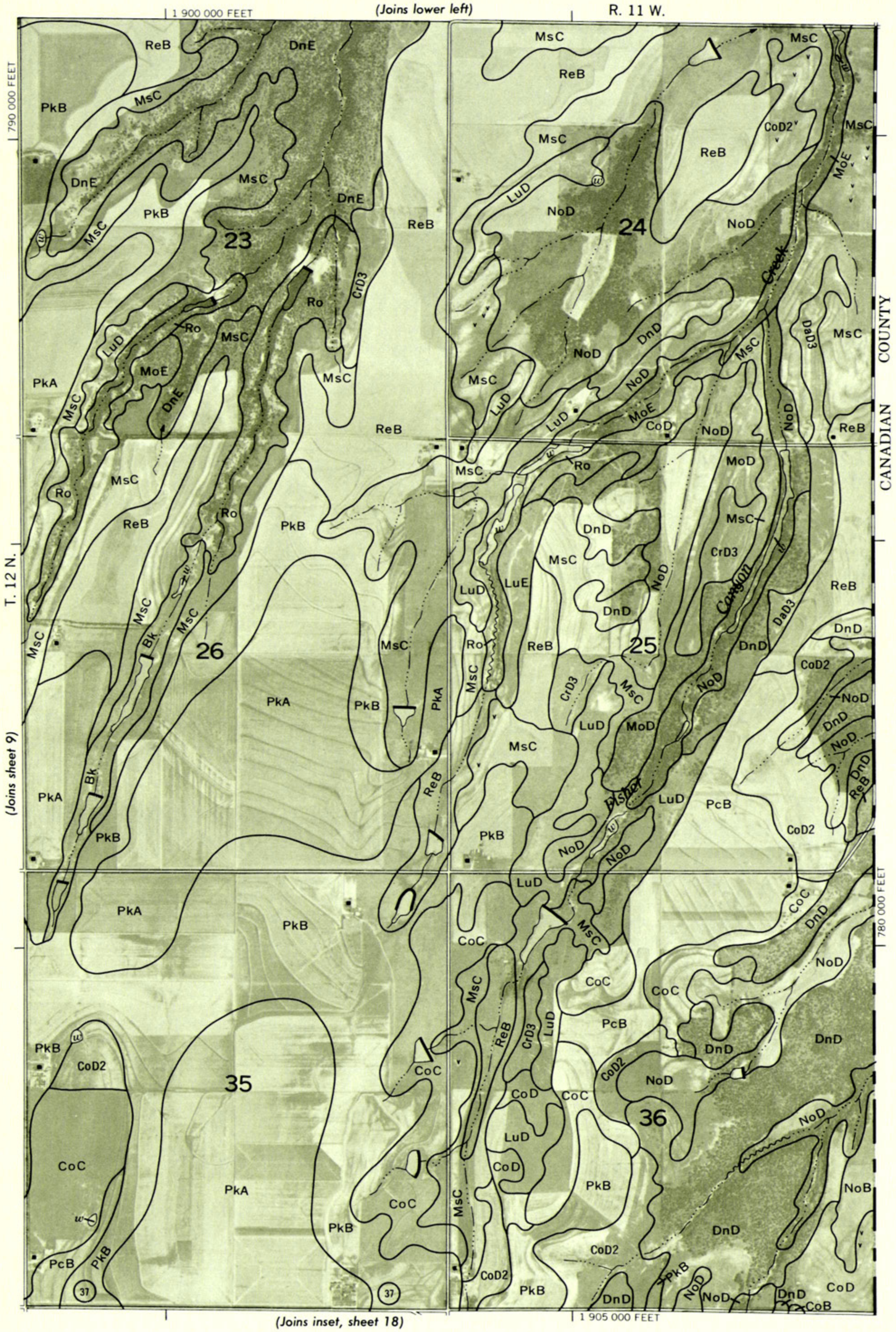
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 49



N

1 Mile
5 000 Feet
Scale 1:20 000

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 5

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 50

CADDO COUNTY, OKLAHOMA NO. 50

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

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Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 51

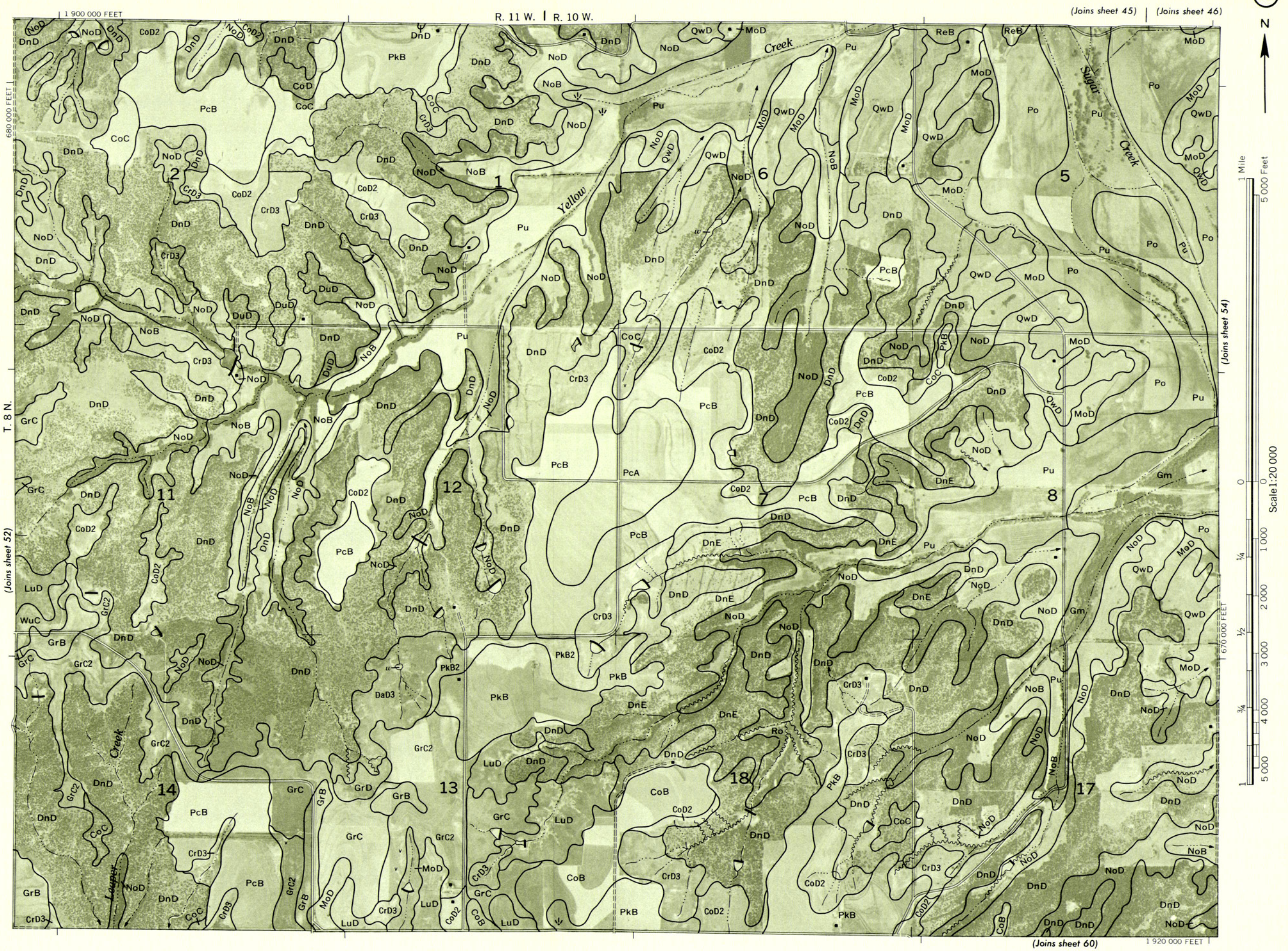
CADDO COUNTY, OKLAHOMA — SHEET NUMBER 52

CADDO COUNTY, OKLAHOMA NO. 52

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 19 , as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 53

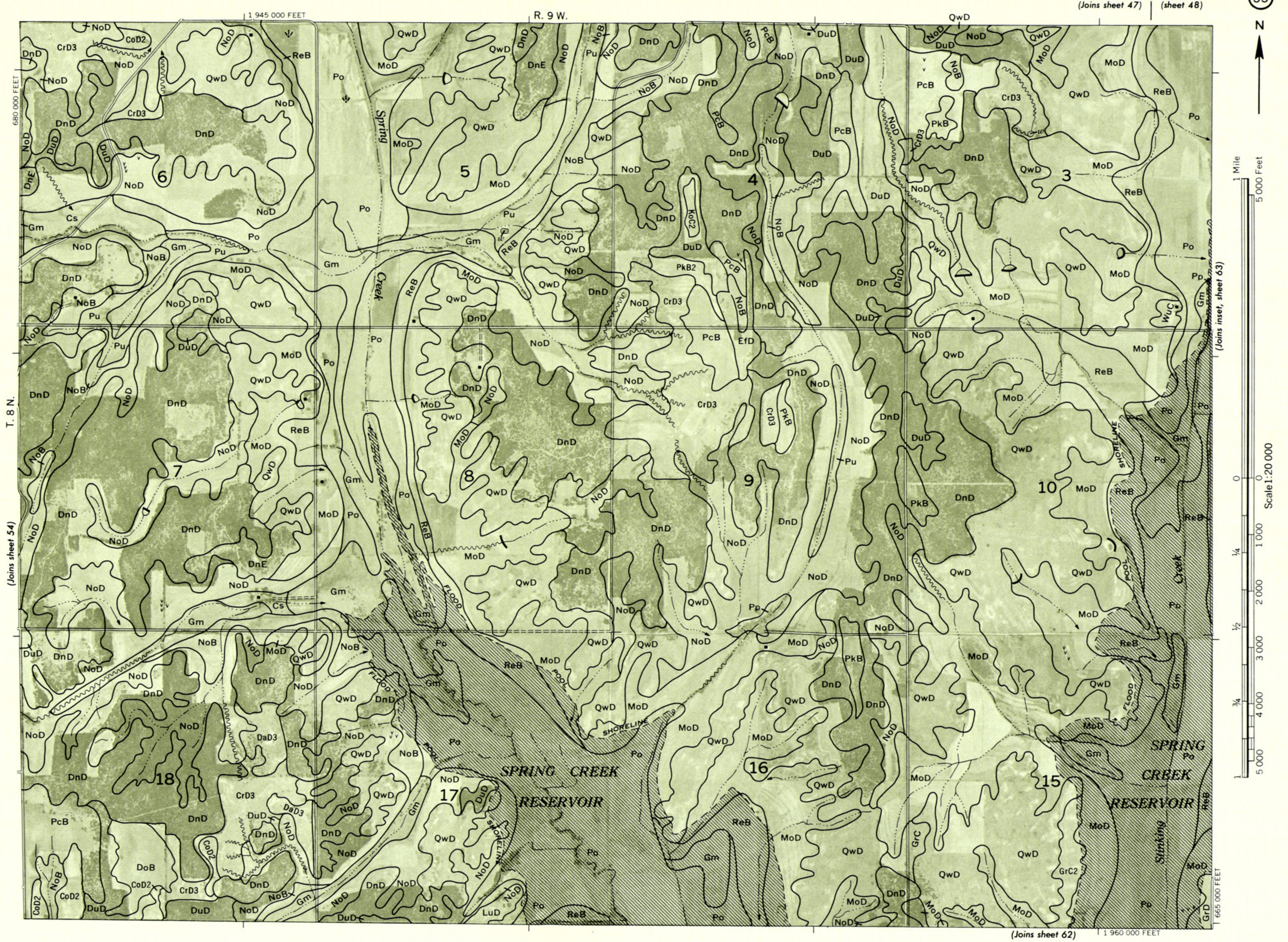
54

CADDO COUNTY, OKLAHOMA NO. 54

Land division corners are approximately positioned on this map.

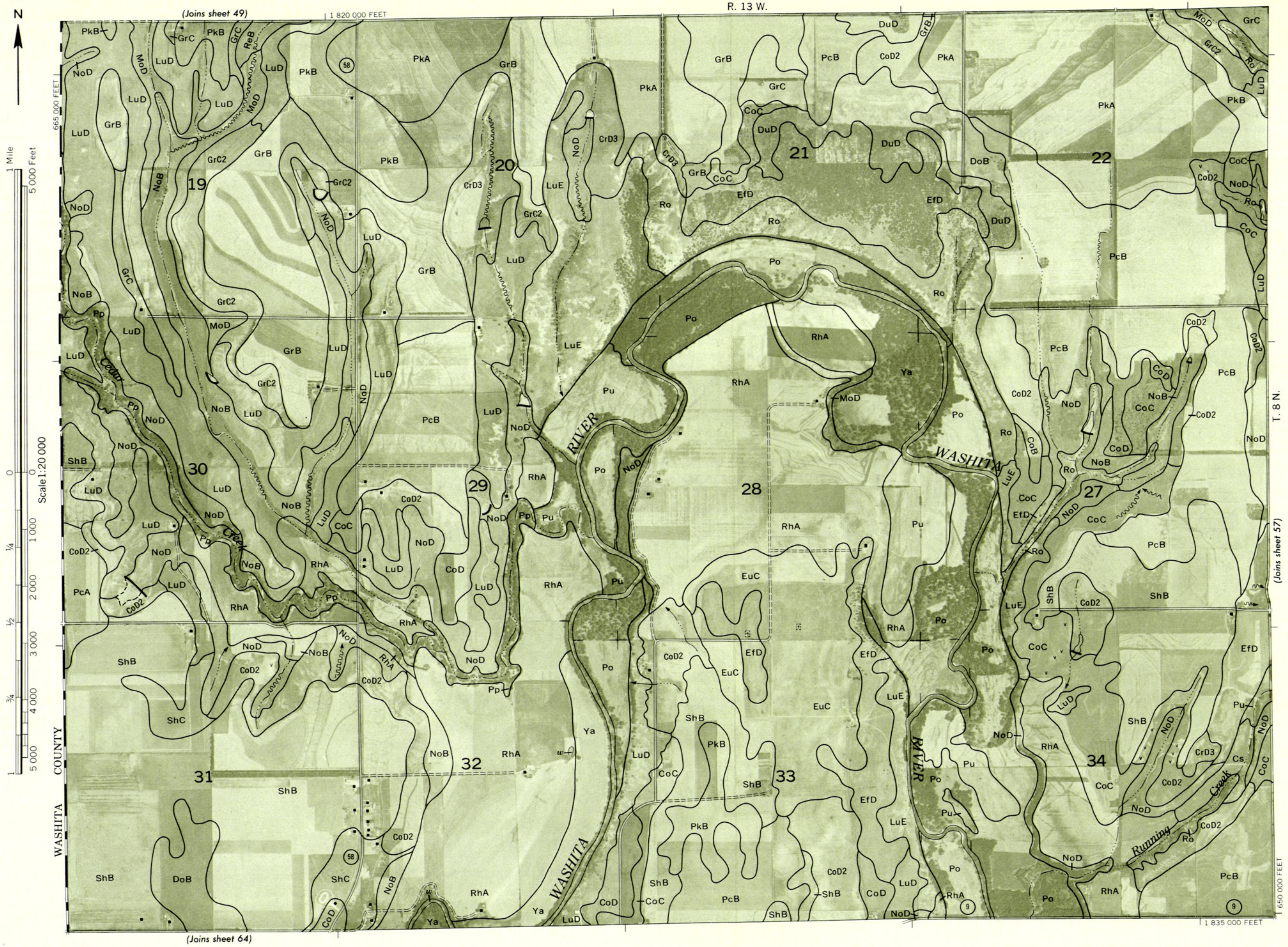
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 197 , as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 55



CADDO COUNTY, OKLAHOMA NO. 56

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

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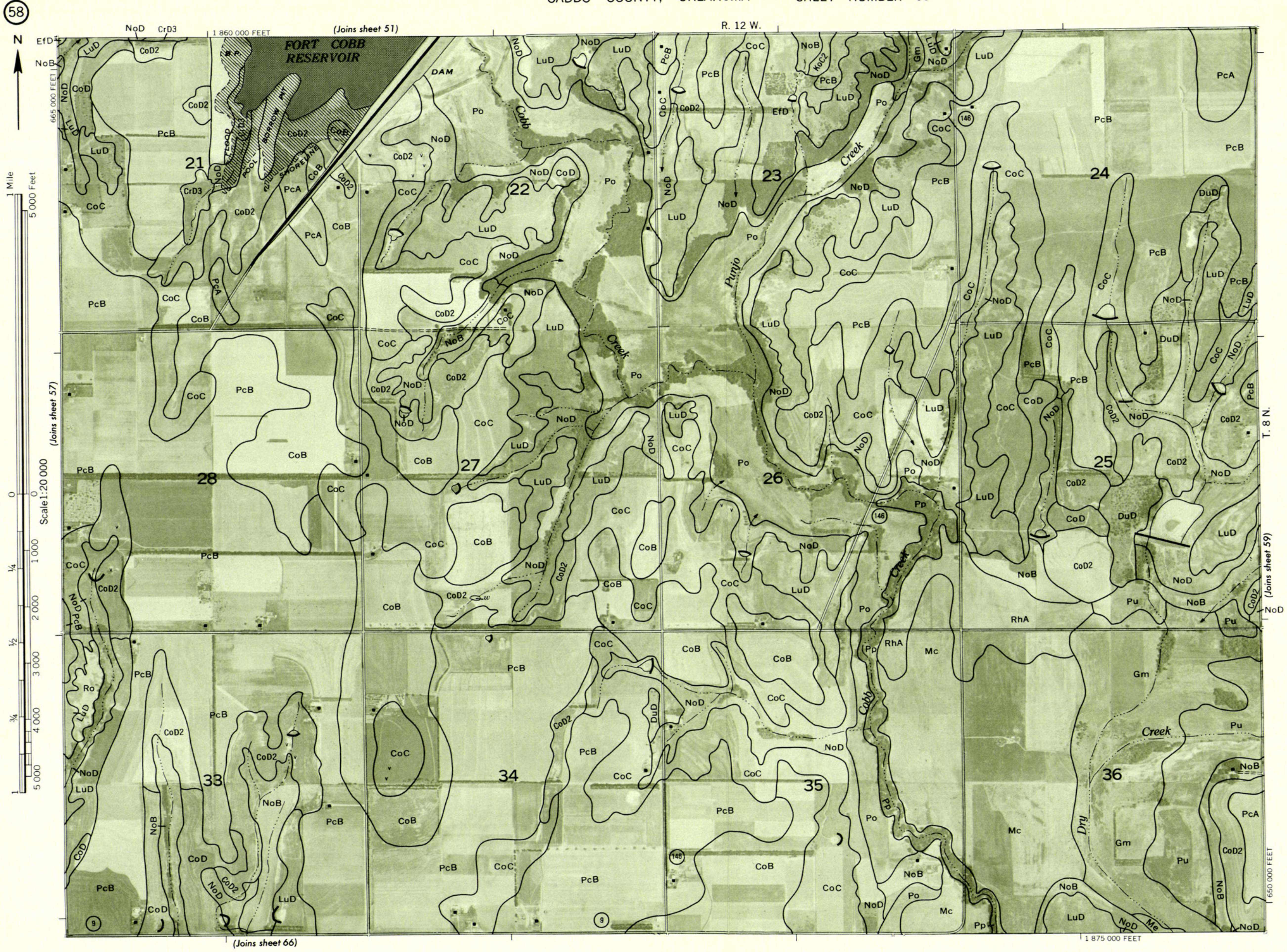
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 57



CADDO COUNTY, OKLAHOMA NO. 58

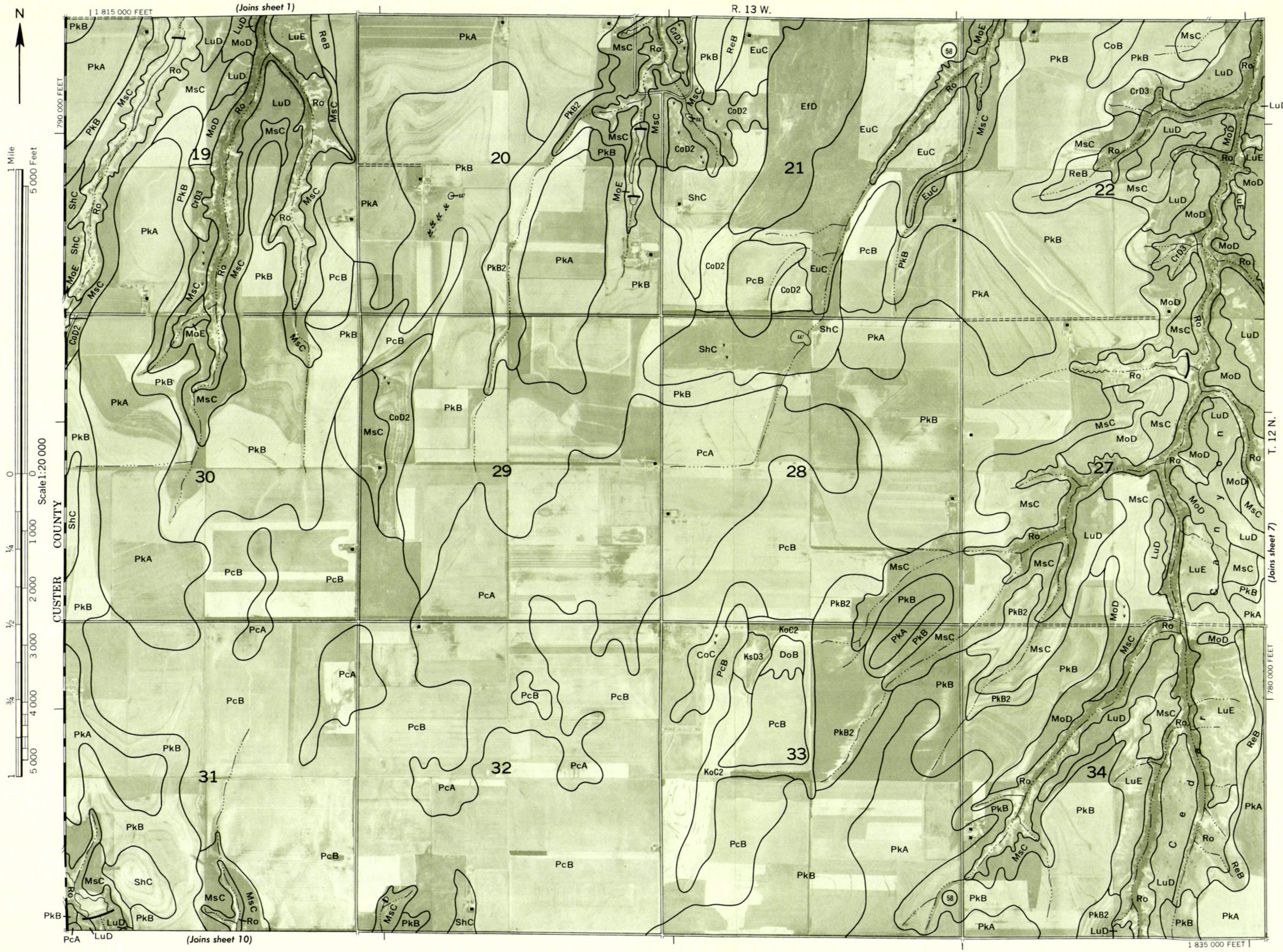
Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 19 , as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 6

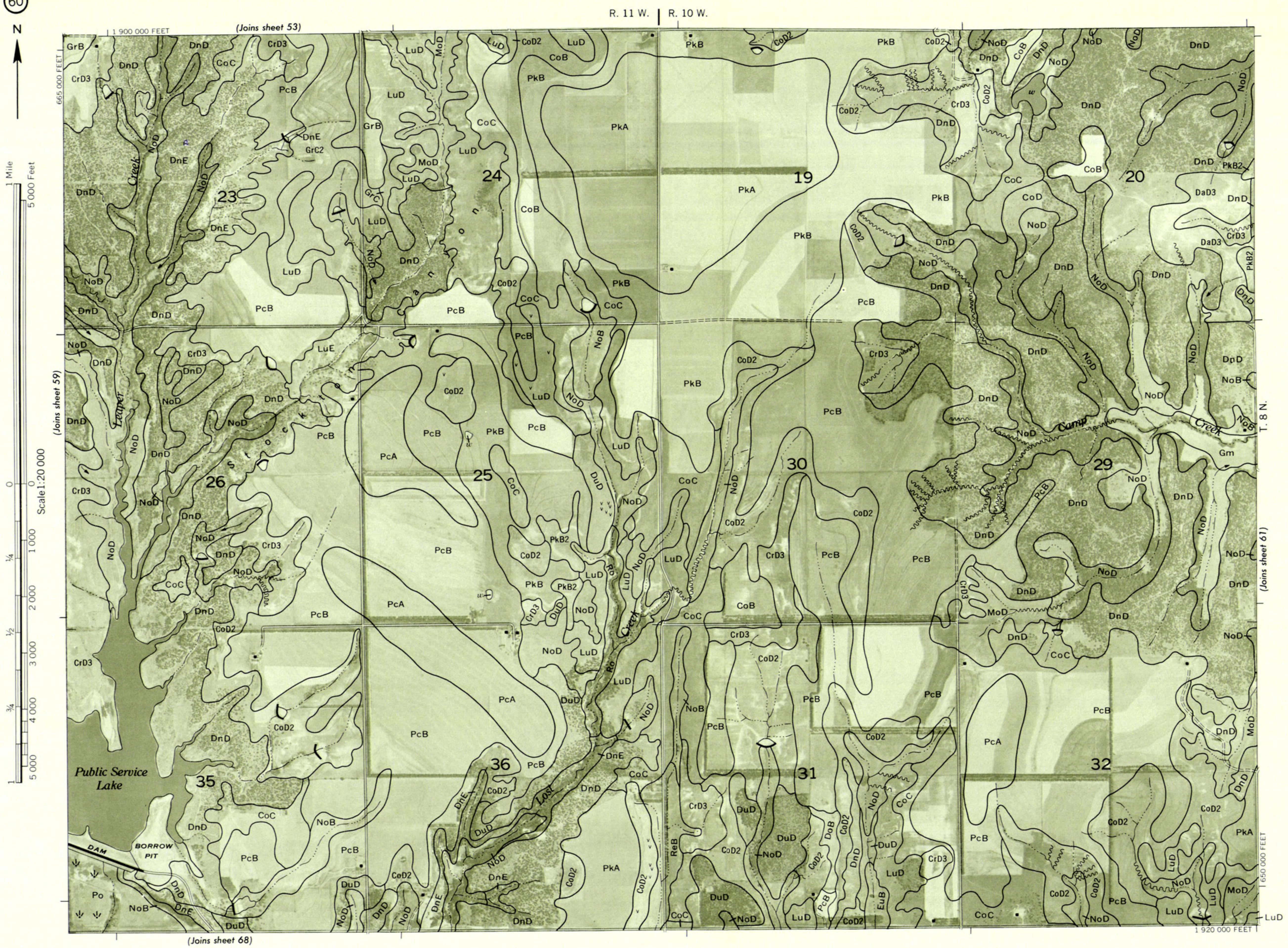


CADDO COUNTY, OKLAHOMA NO. 6

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

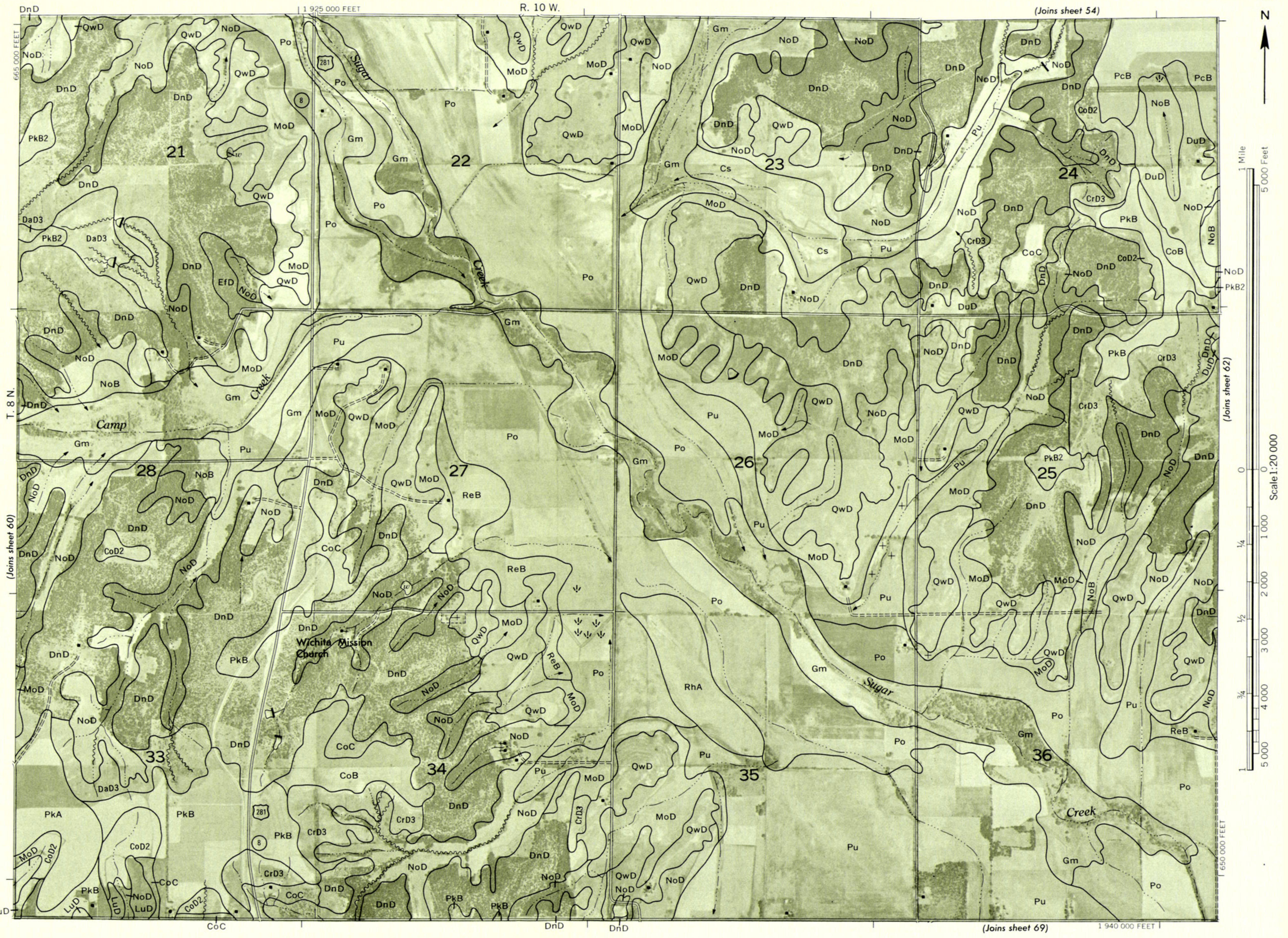


CADDO COUNTY, OKLAHOMA NO. 60

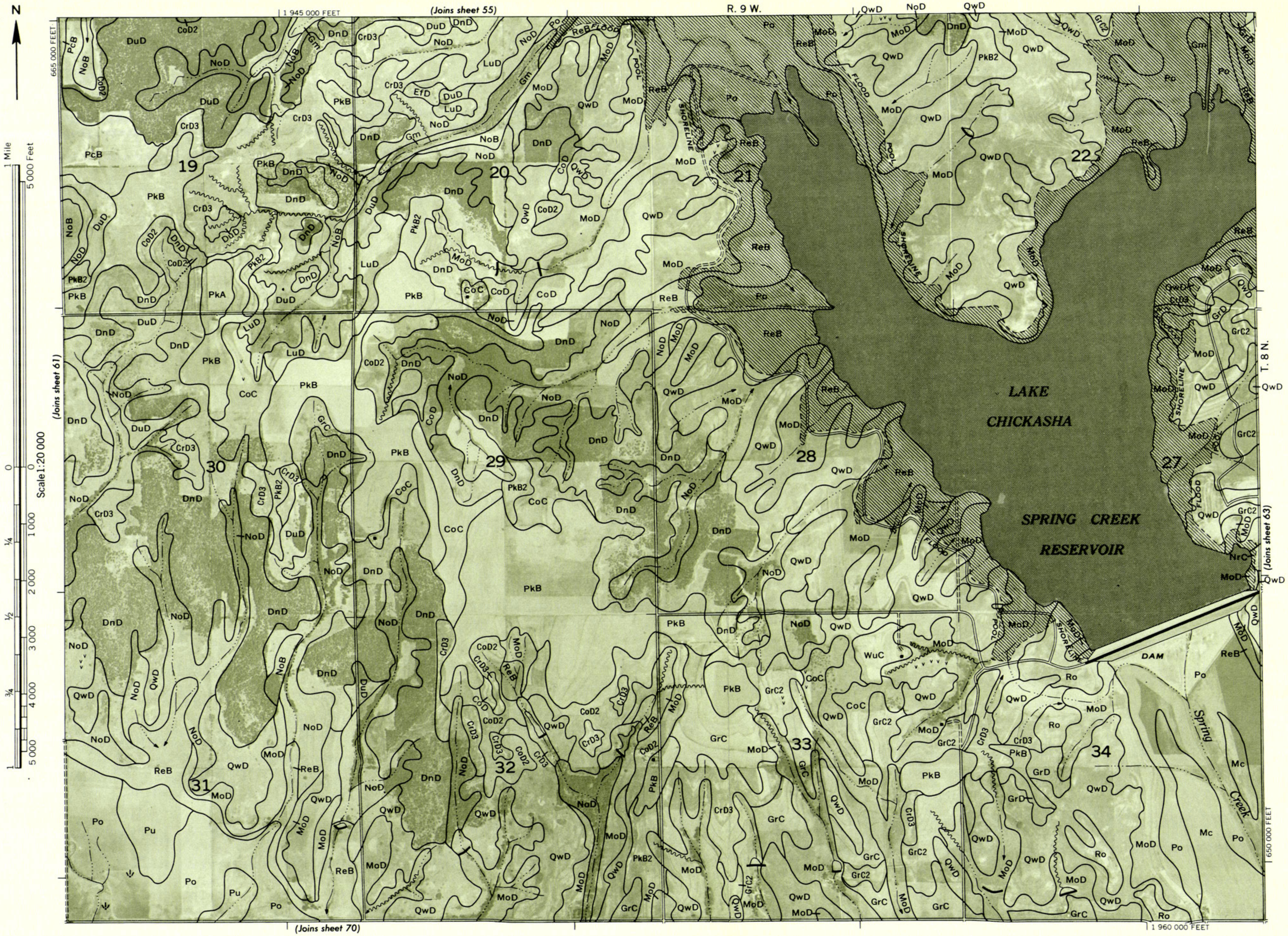
Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of set compiled in 197 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.



CADDO COUNTY, OKLAHOMA NO. 62

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

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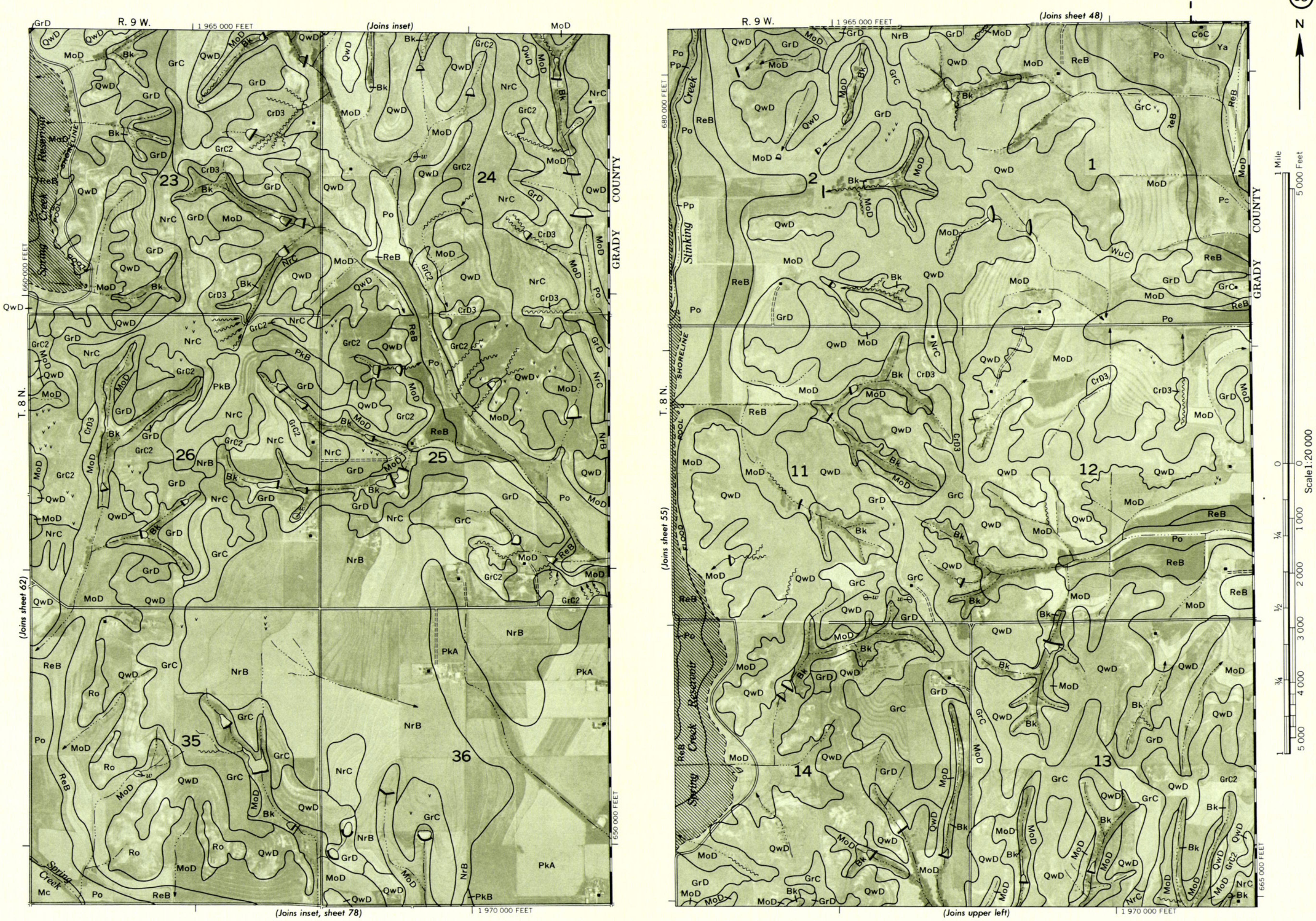
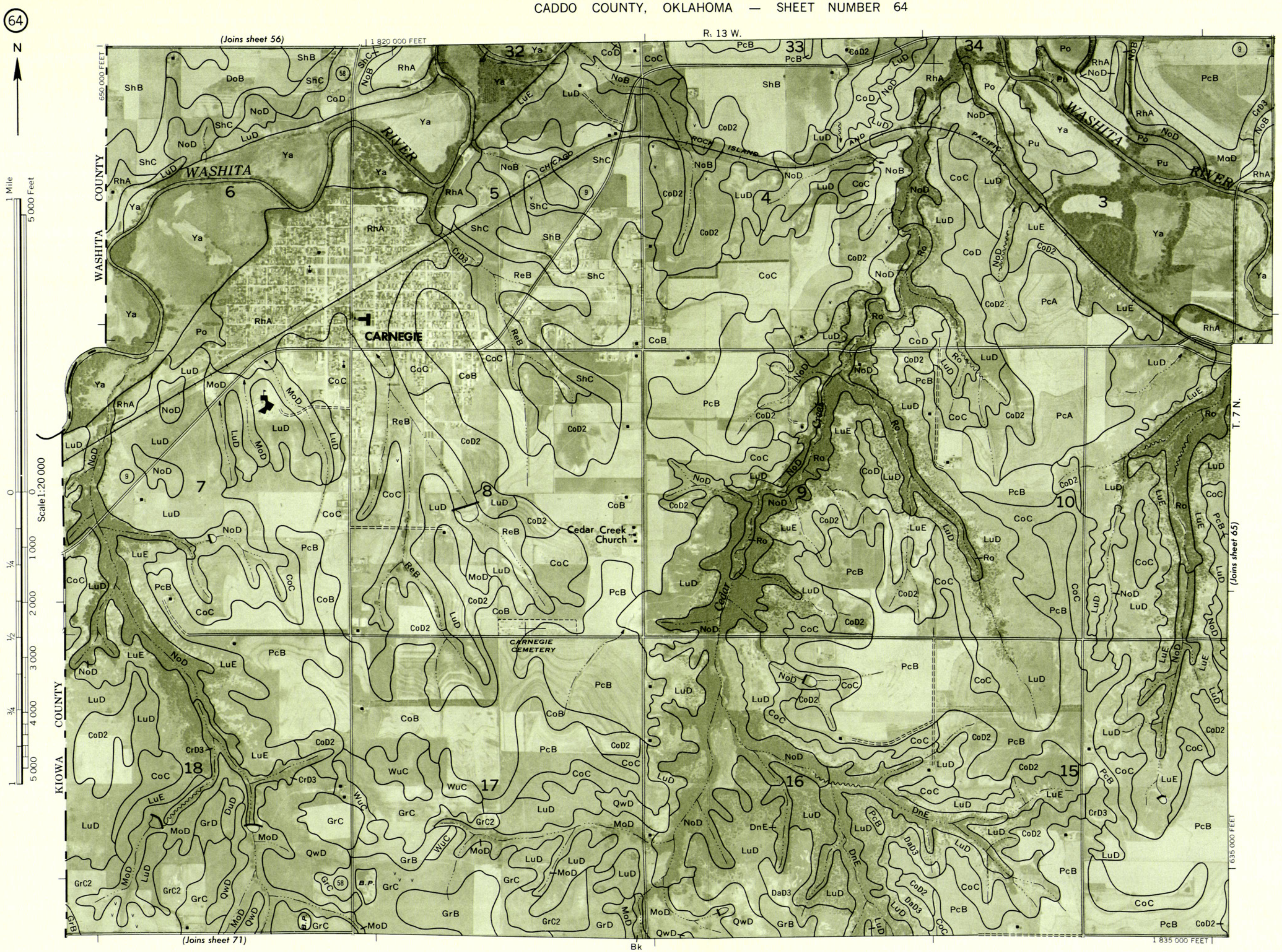
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 63





CADDO COUNTY, OKLAHOMA NO. 64

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

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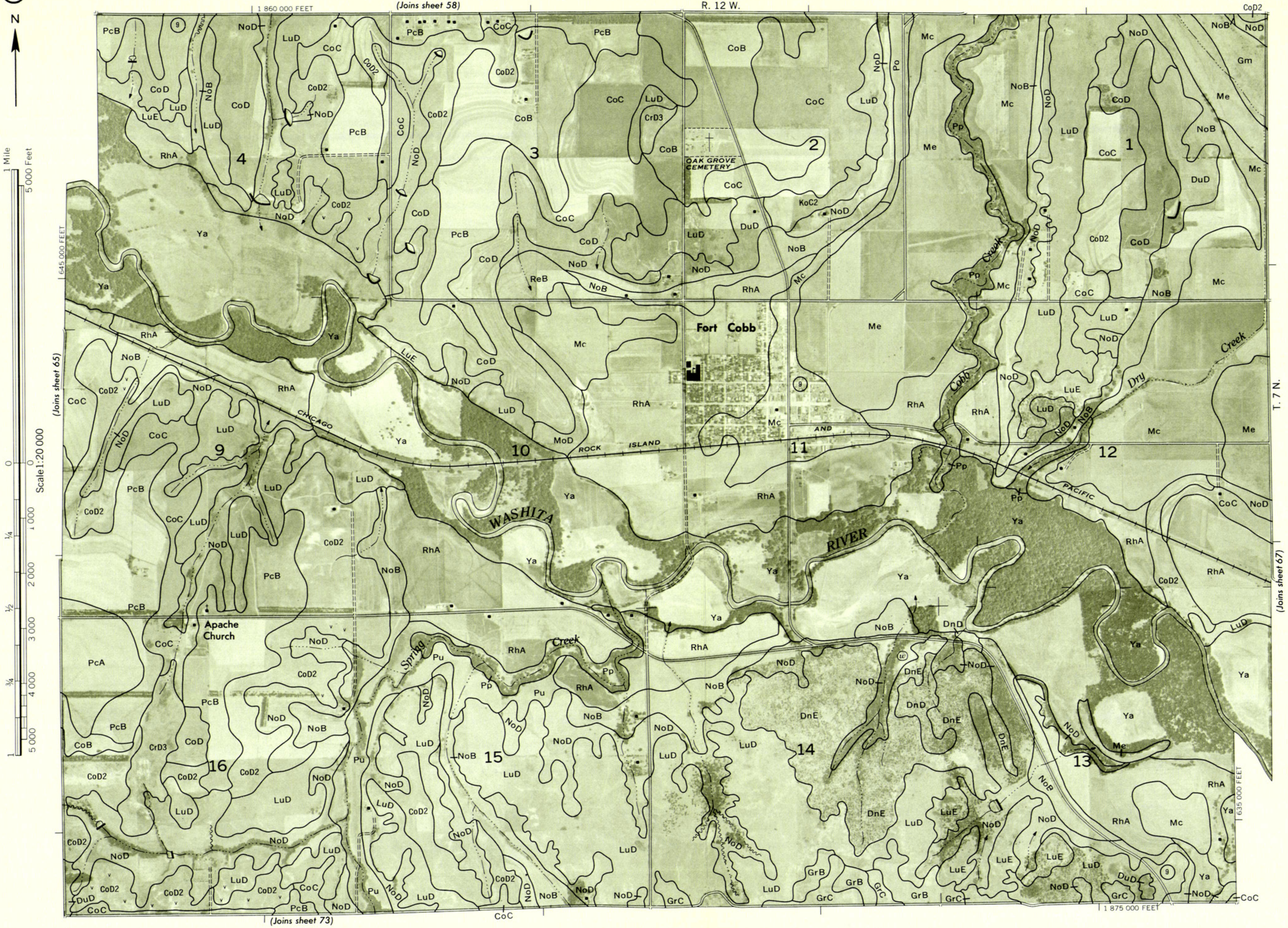
CADDO COUNTY, OKLAHOMA NO. 65

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 66



CADDO COUNTY, OKLAHOMA NO. 66

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

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This map is one of a set compiled in 197?, as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 67

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 68

CADDO COUNTY, OKLAHOMA NO. 68

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

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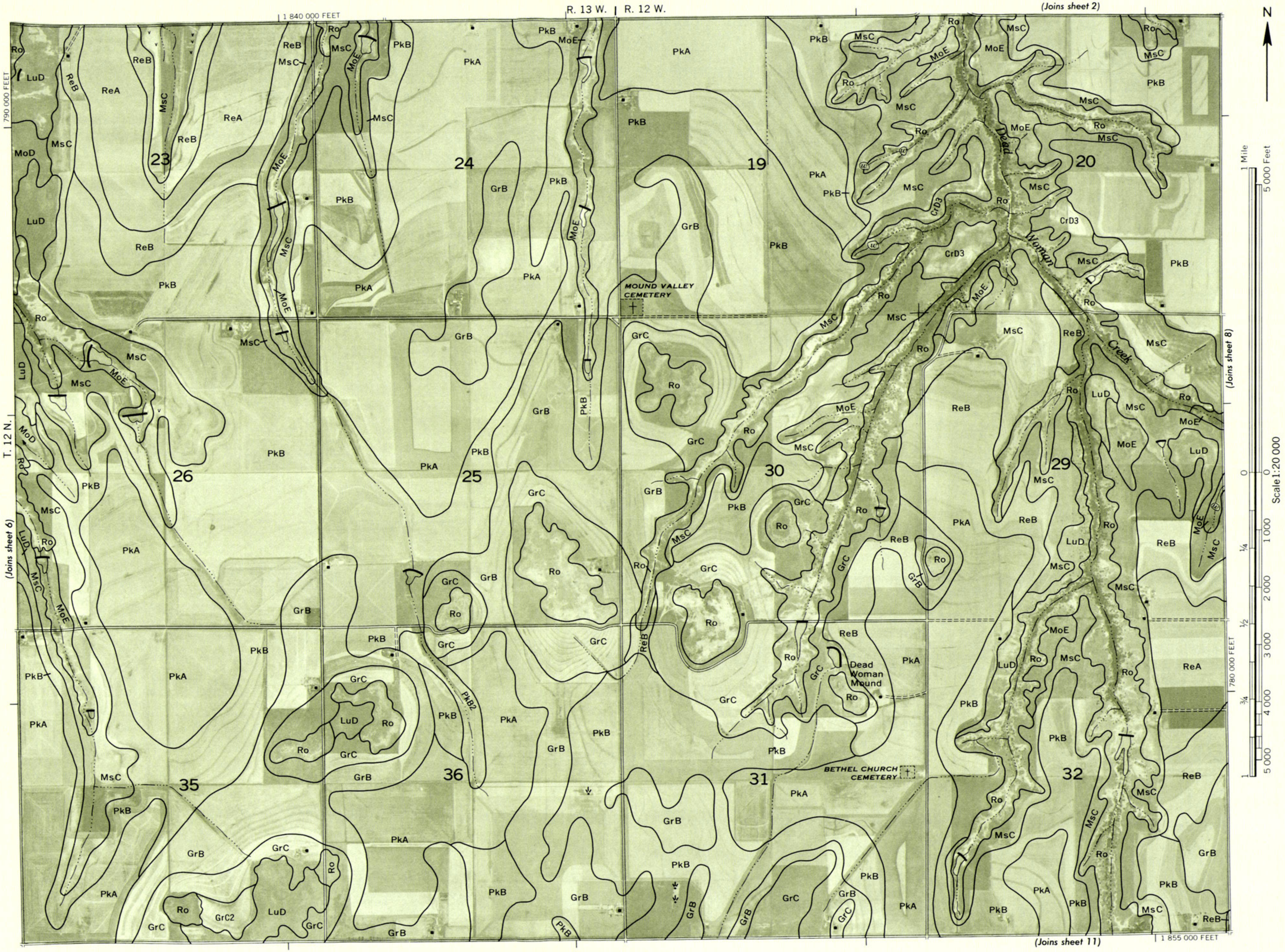
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 69



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 7

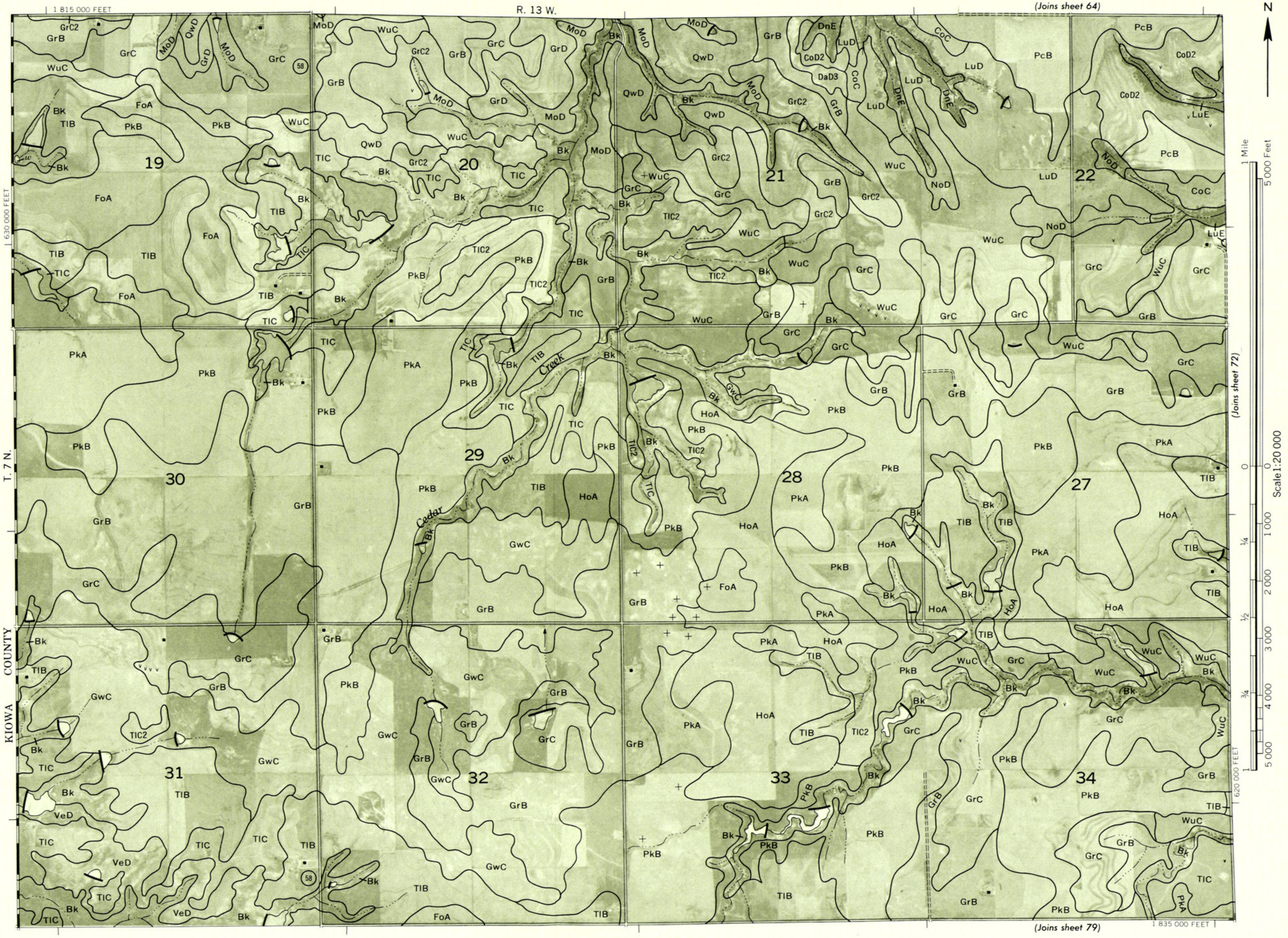
CADDO COUNTY, OKLAHOMA — SHEET NUMBER 70

CADDO COUNTY, OKLAHOMA NO. 70

Land division corners are approximately positioned on this map.

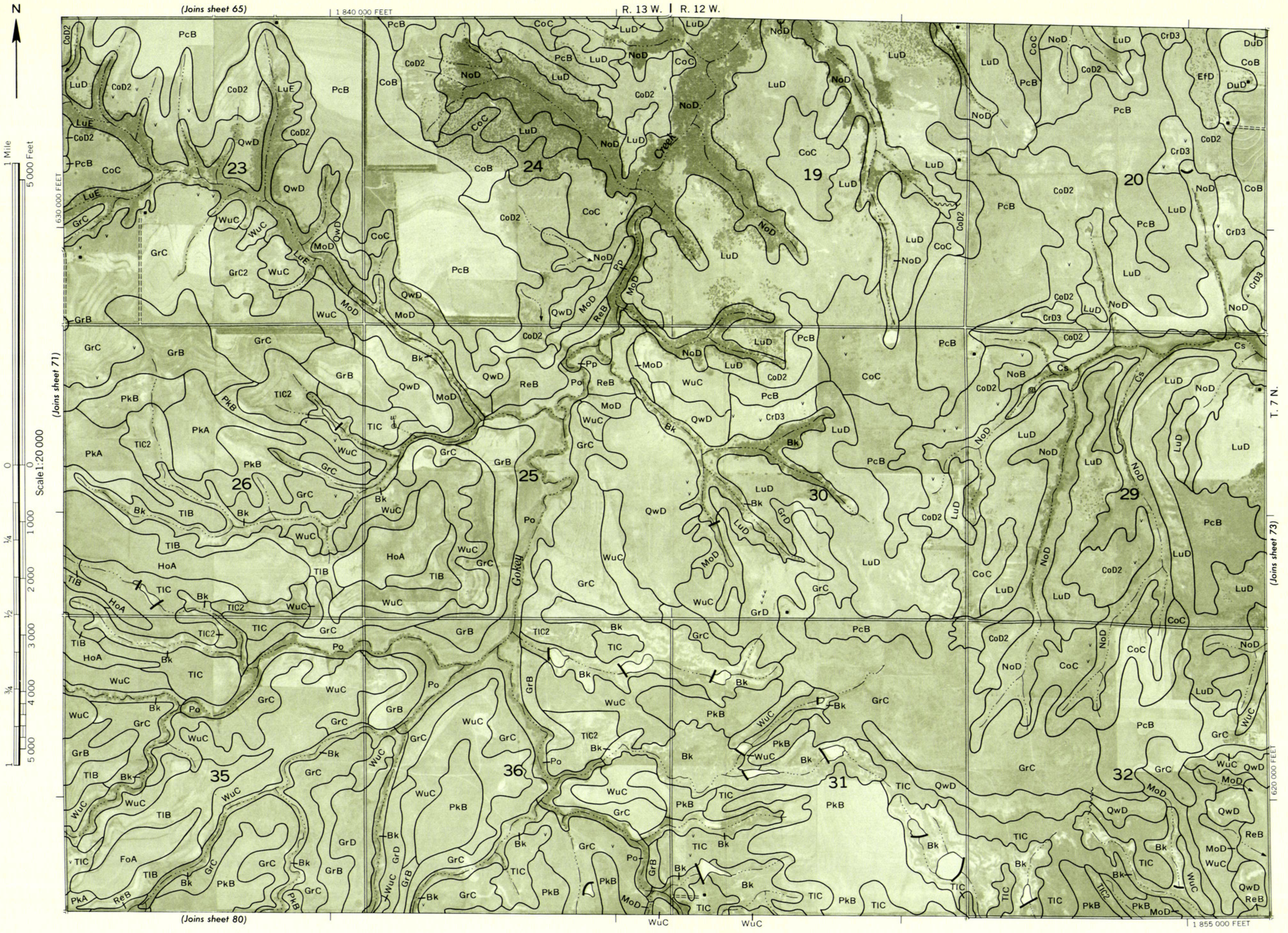
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 71



CADDO COUNTY, OKLAHOMA NO. 72

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 19 , as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

This map is one of a set compiled in 1971, as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

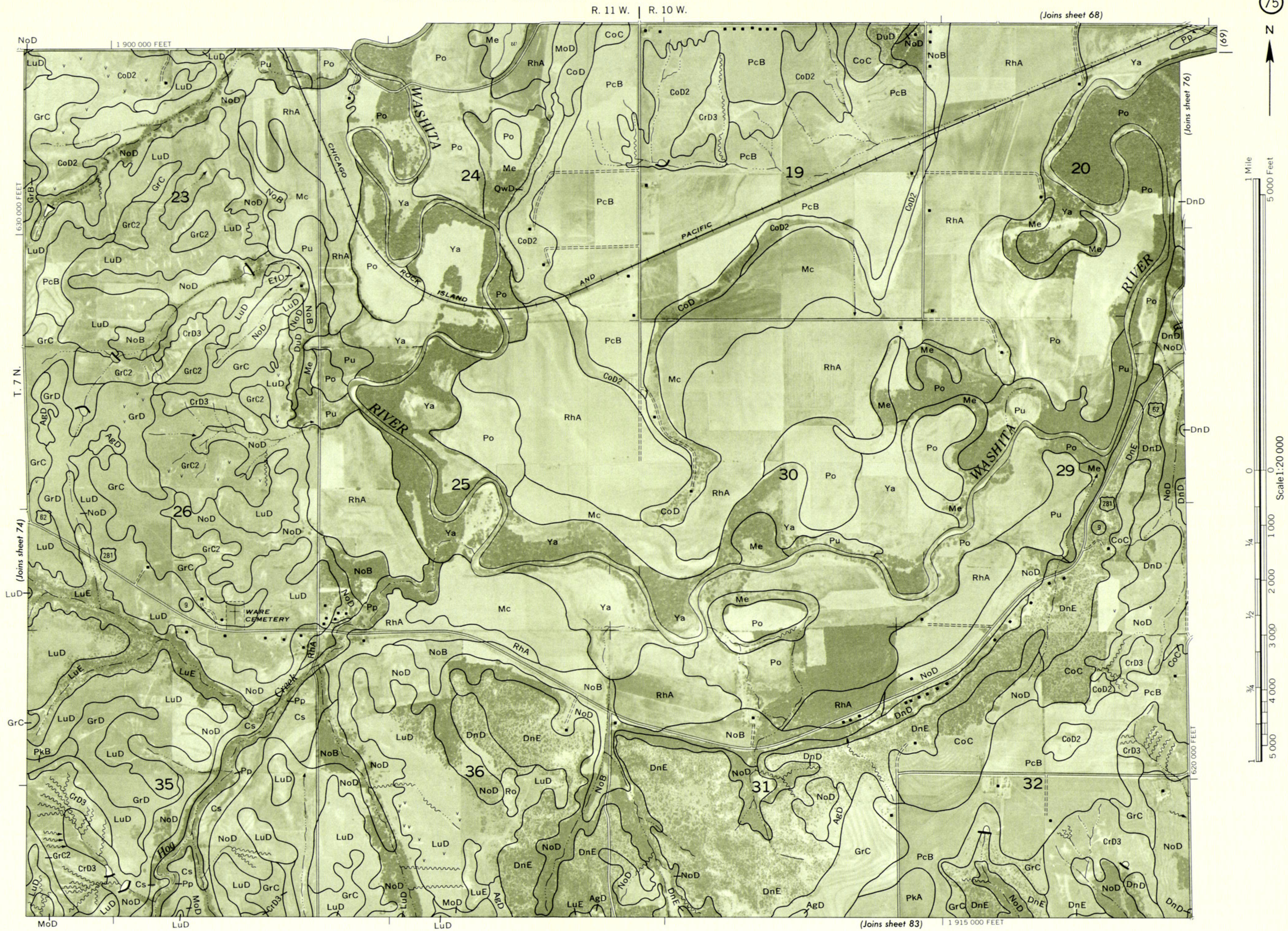
CADDO COUNTY, OKLAHOMA NO. 73

CADDO COUNTY, OKLAHOMA NO. 74

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.



This map is one of a set compiled in 19[illegible] as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 75

CADDO COUNTY, OKLAHOMA NO. 76

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

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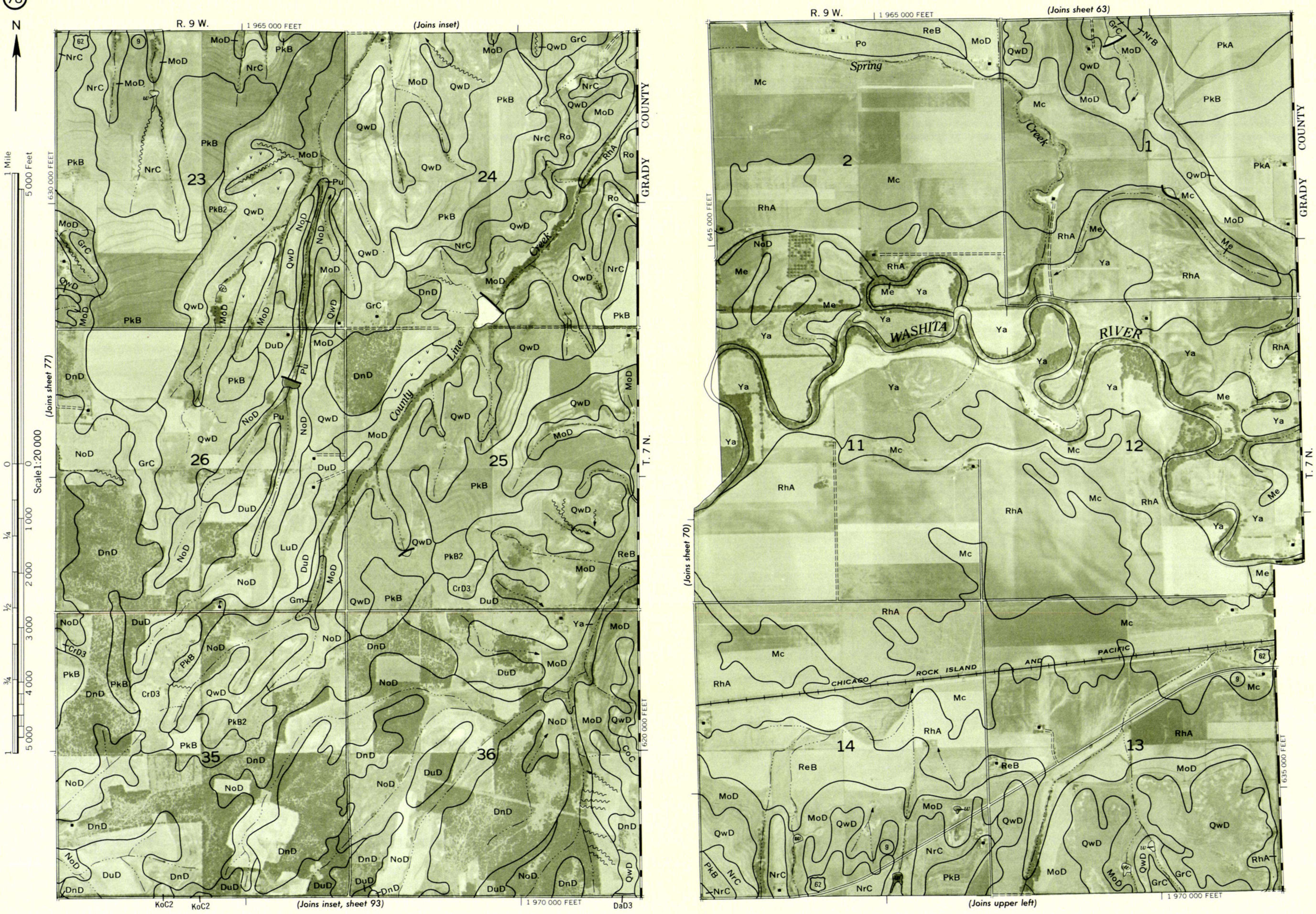
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 77

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 78

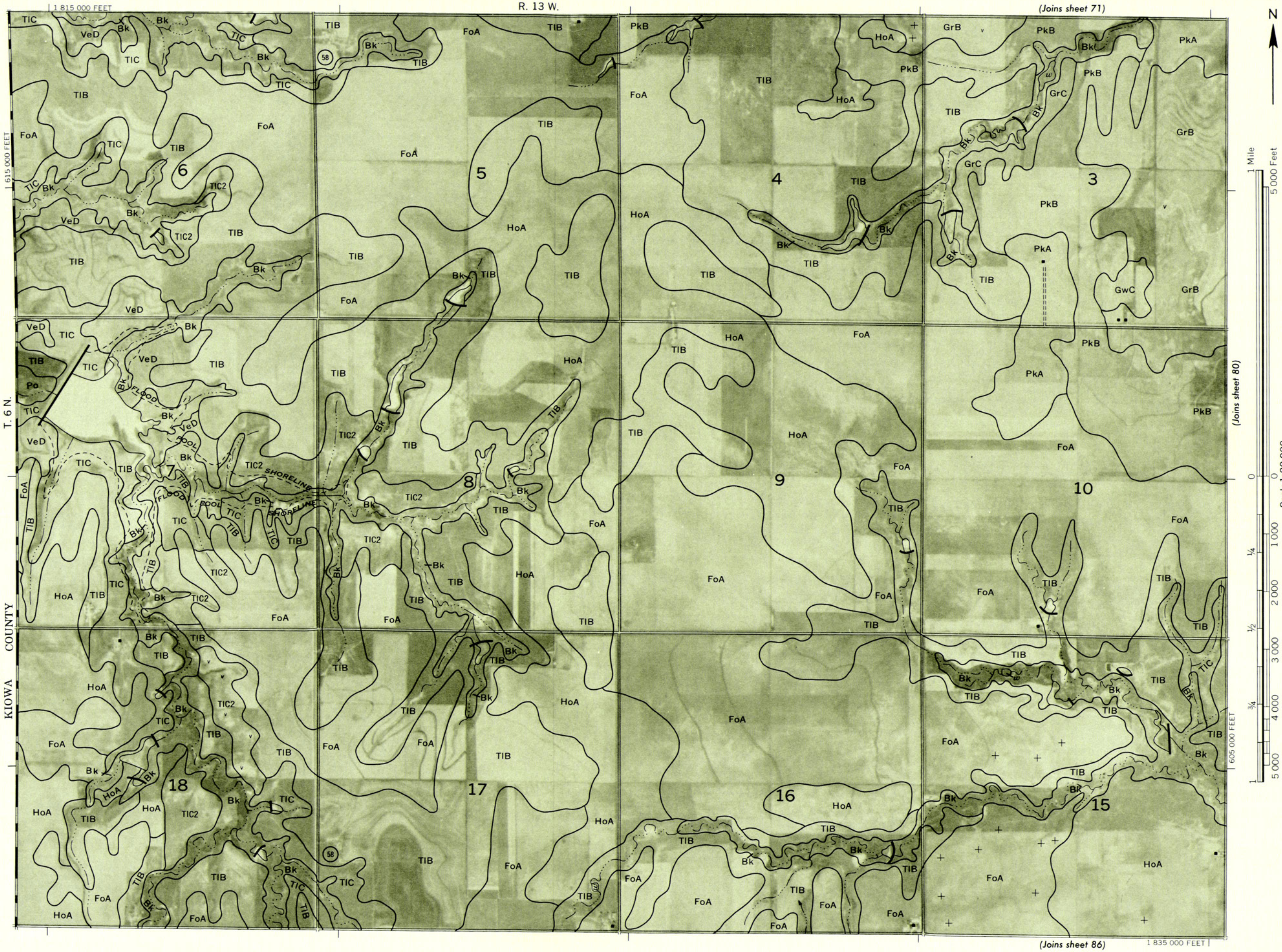


CADDO COUNTY, OKLAHOMA NO. 78

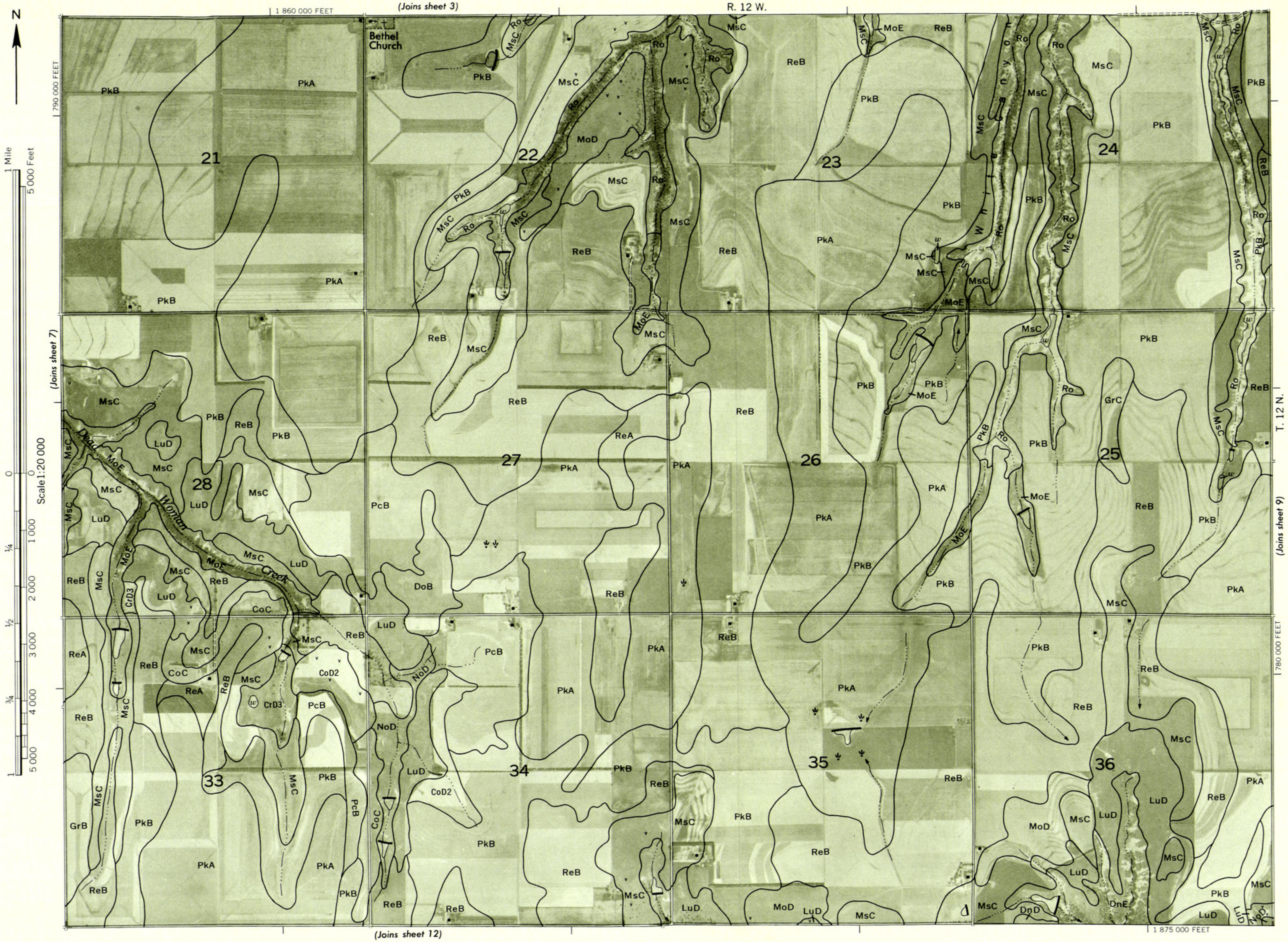
Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.



This map is one of a set compiled in 1971, as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.
CADDO COUNTY, OKLAHOMA NO. 79



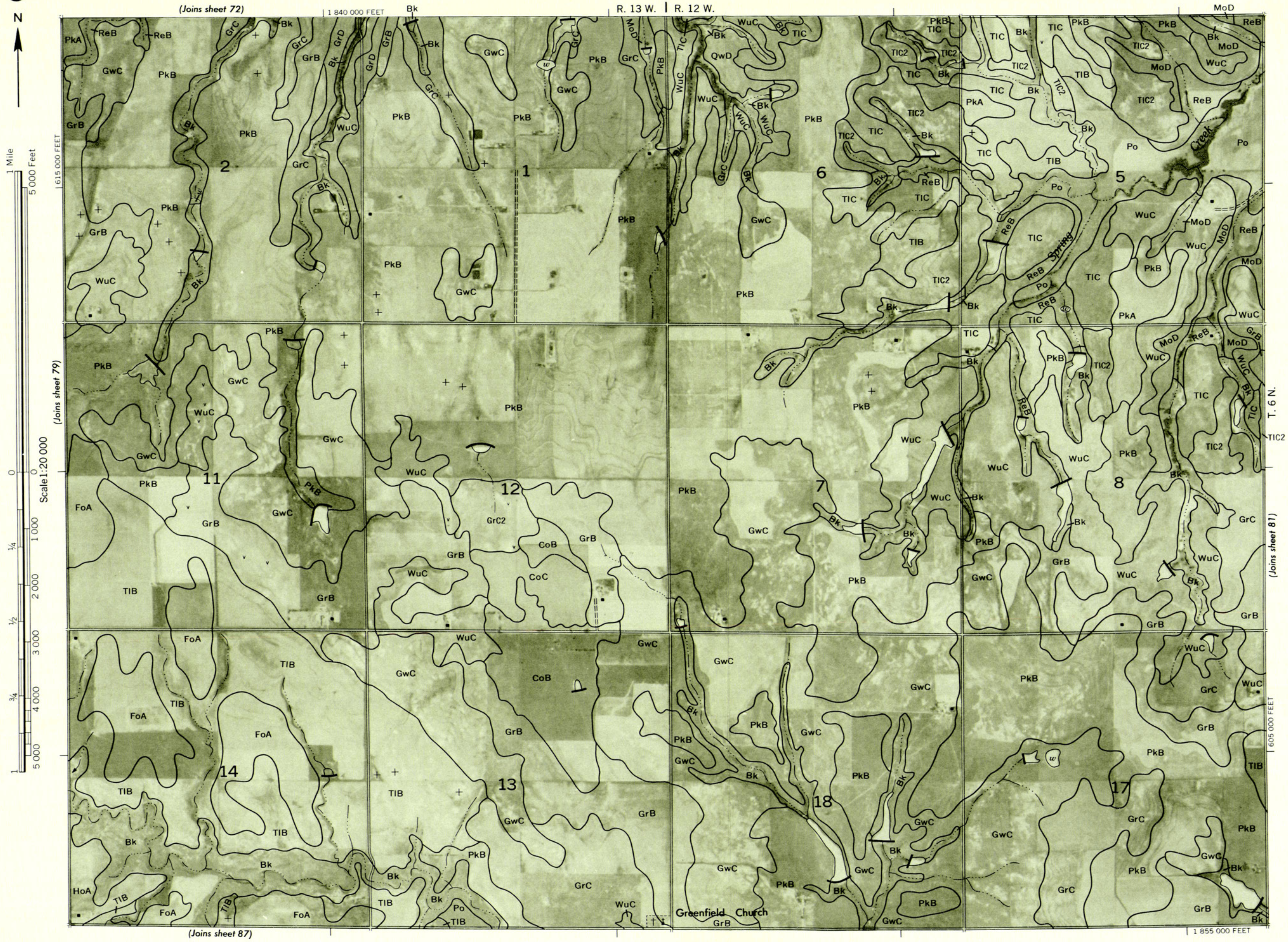
CADDO COUNTY, OKLAHOMA NO. 8

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 80



CADDO COUNTY, OKLAHOMA NO. 80

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

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Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 81

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 82

N

1 Mile

5 000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

CADDO COUNTY, OKLAHOMA NO. 82

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 83

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 83

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 84

CADDO COUNTY, OKLAHOMA NO. 84

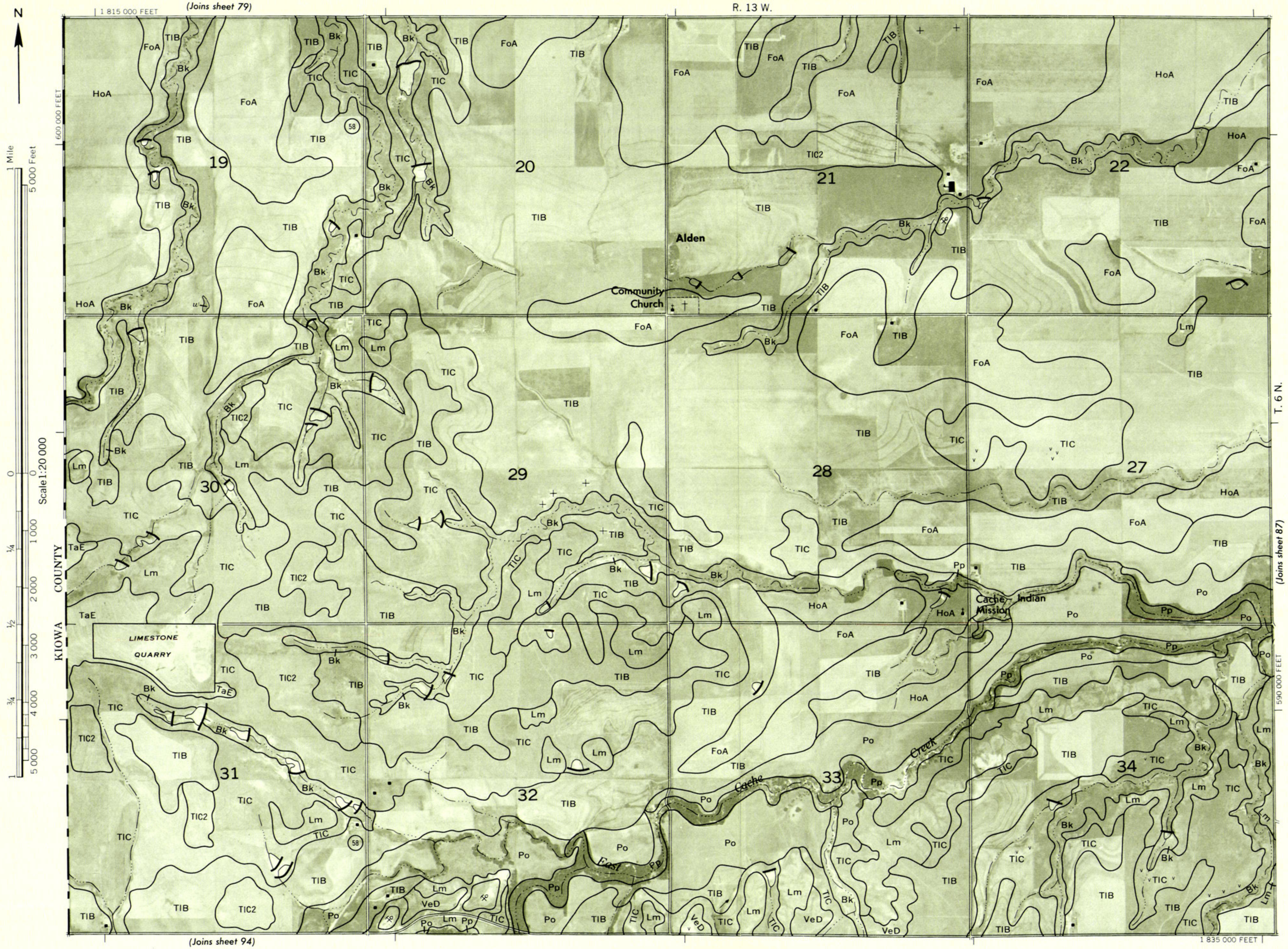
Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

This map is one of a set compiled in 1971, as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.
CADDO COUNTY, OKLAHOMA NO. 85

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 86



CADDO COUNTY, OKLAHOMA NO. 86

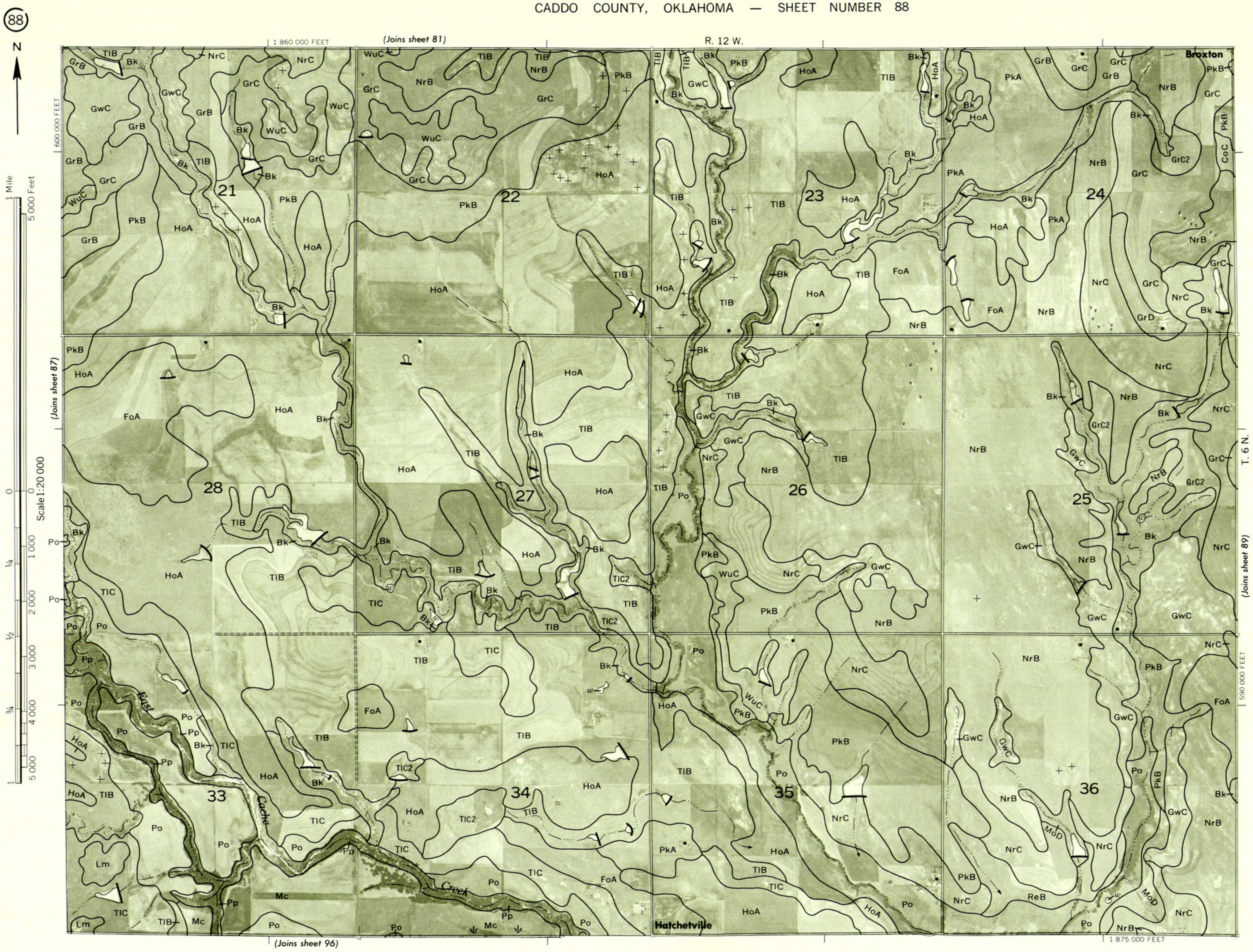
Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

This map is one of a set compiled in 197[illegible] as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 87

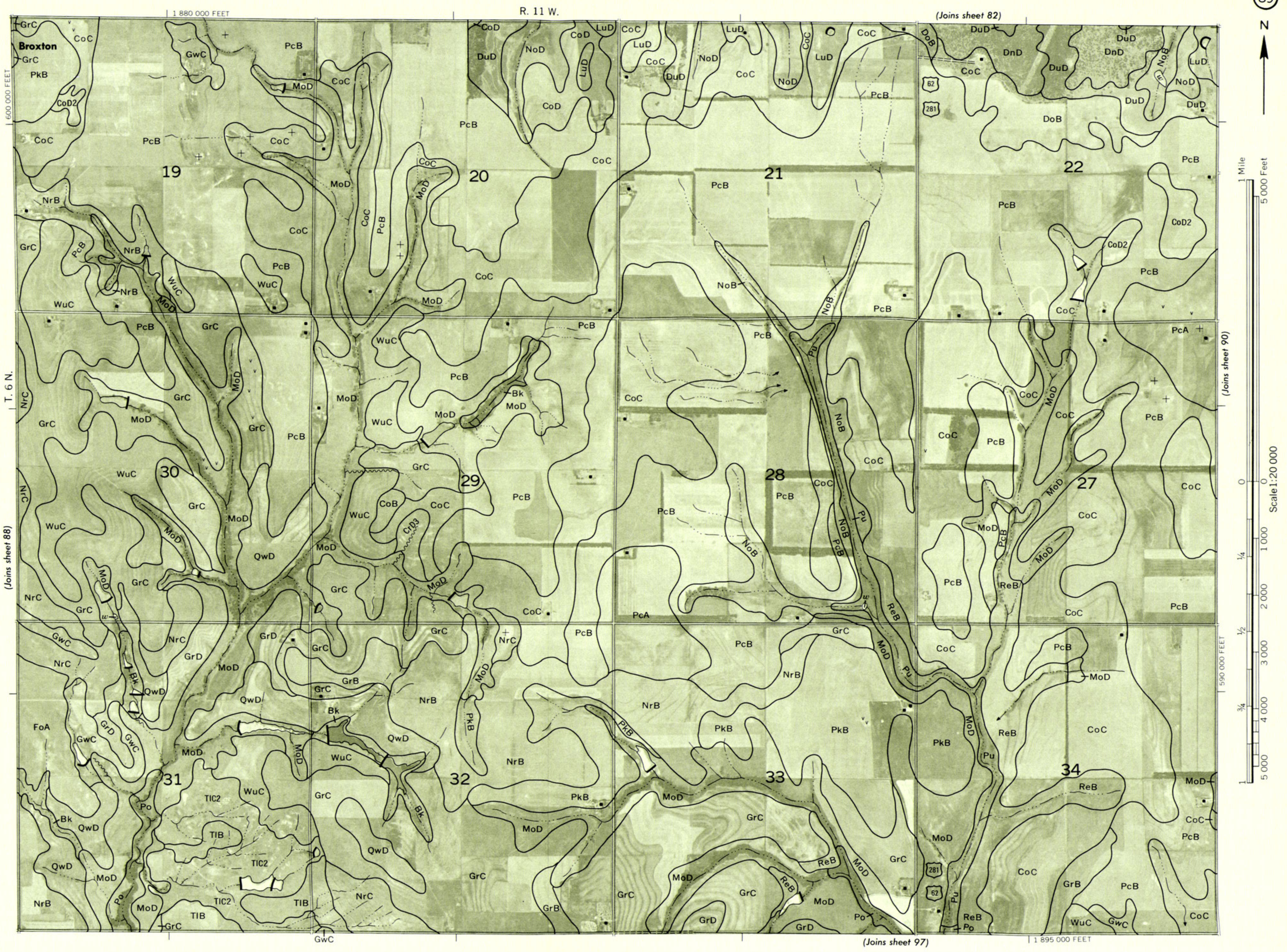


CADDO COUNTY, OKLAHOMA NO. 88

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

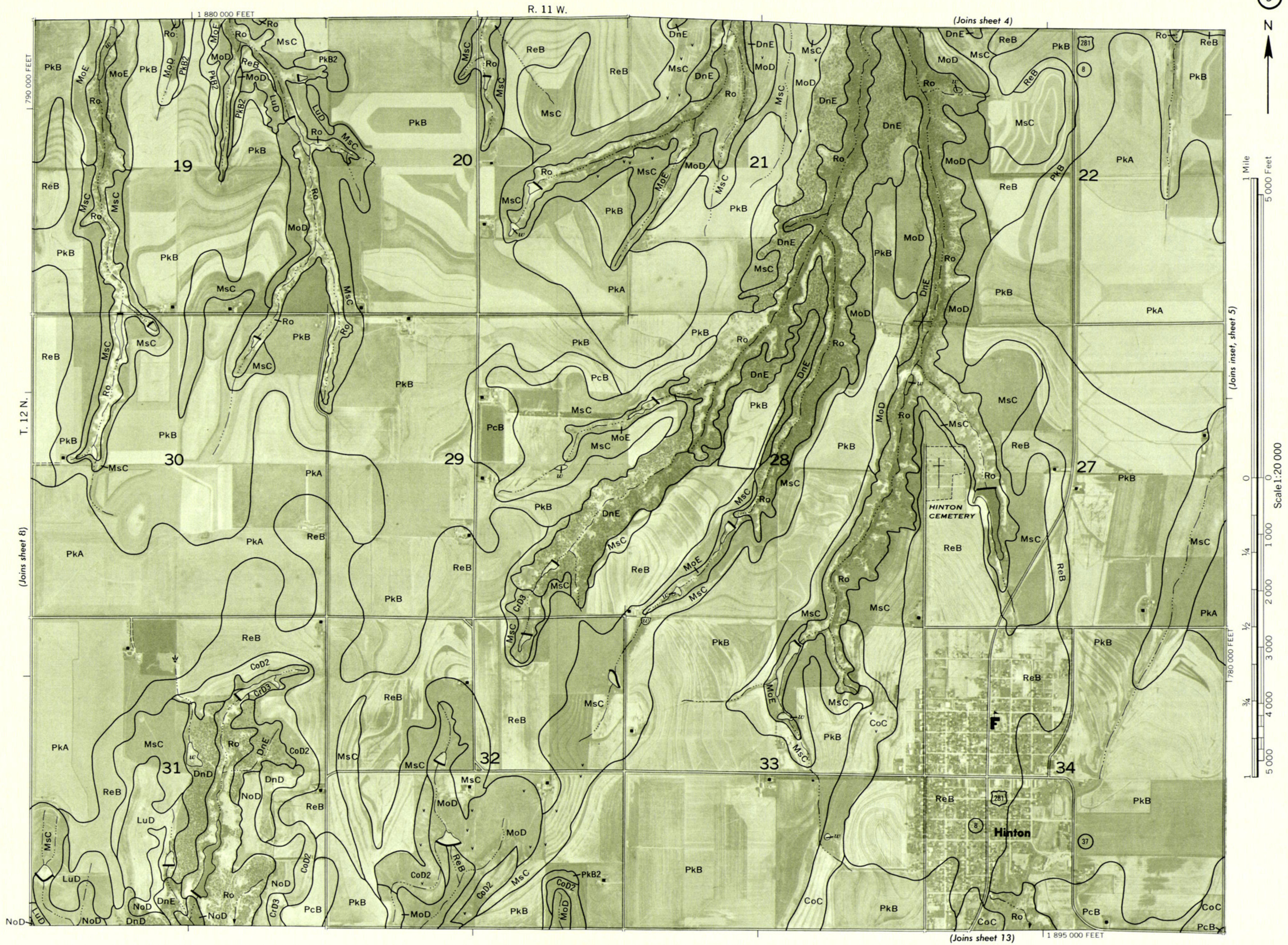
This map is one of a set compiled in 197 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 89

CADDO COUNTY, OKLAHOMA — SHEET NUMBER 9



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 9

90

N

1 Mile

5 000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

CADDO COUNTY, OKLAHOMA NO. 90

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a compiled in 1971 is part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Ex riment Station.

This map is one of a set compiled in 197_ as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 91

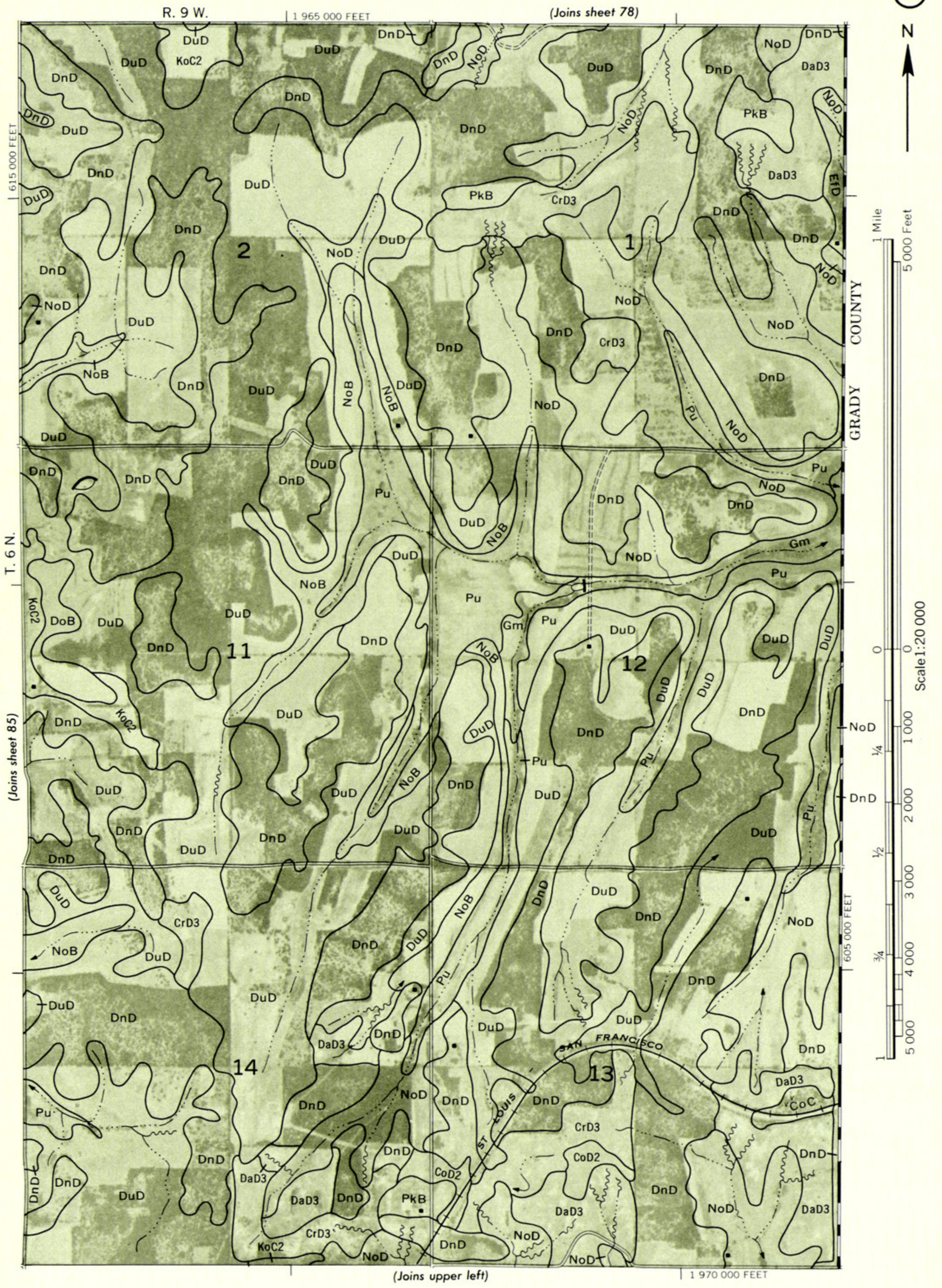
CADDO COUNTY, OKLAHOMA — SHEET NUMBER 92

CADDO COUNTY, OKLAHOMA NO. 92

Land division corners are approximately positioned on this map.

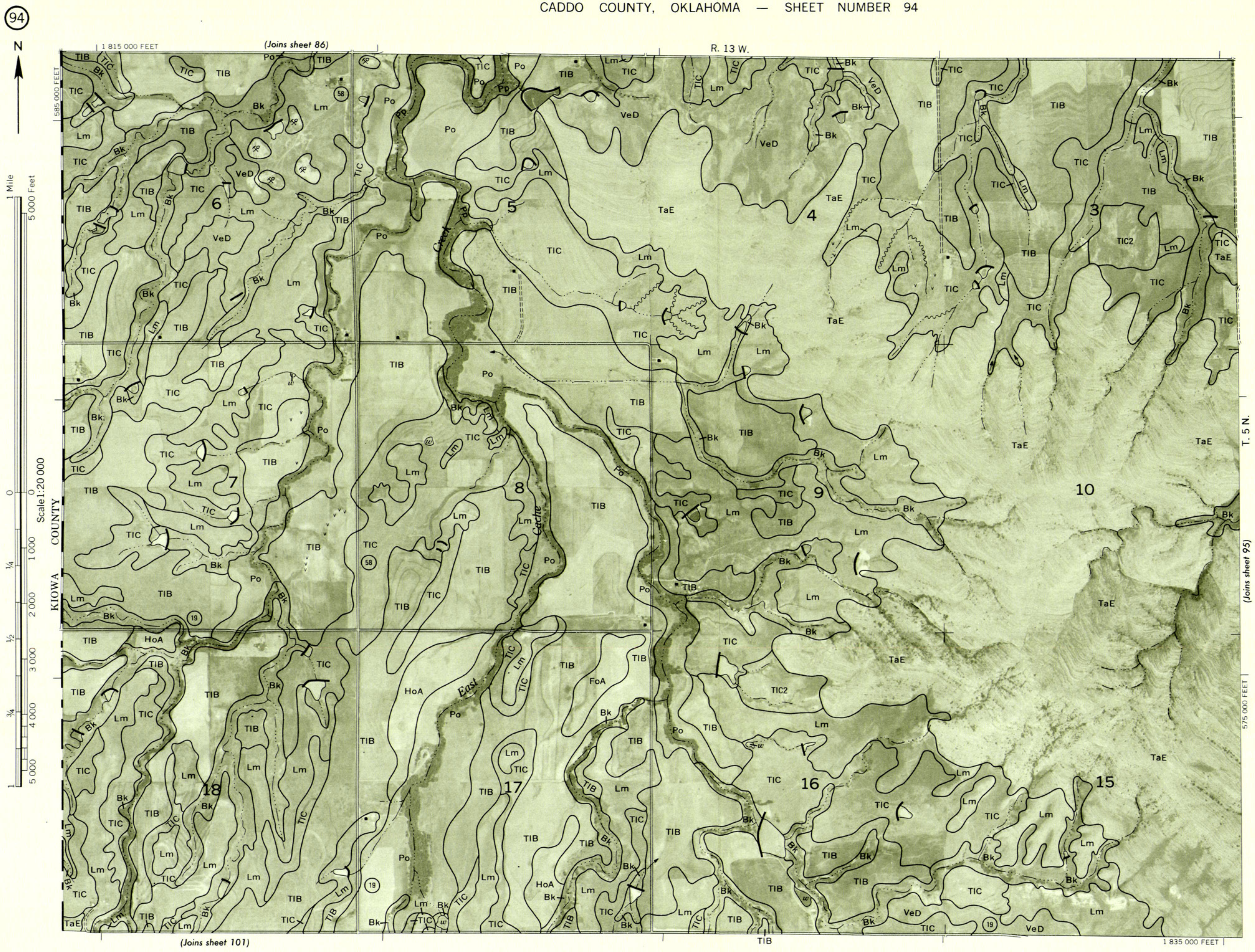
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 197_ as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.



This map is one of a set compiled in 1971, as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 93



CADDO COUNTY, OKLAHOMA NO. 94

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.

This map is one of a set compiled in 197[illegible] as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

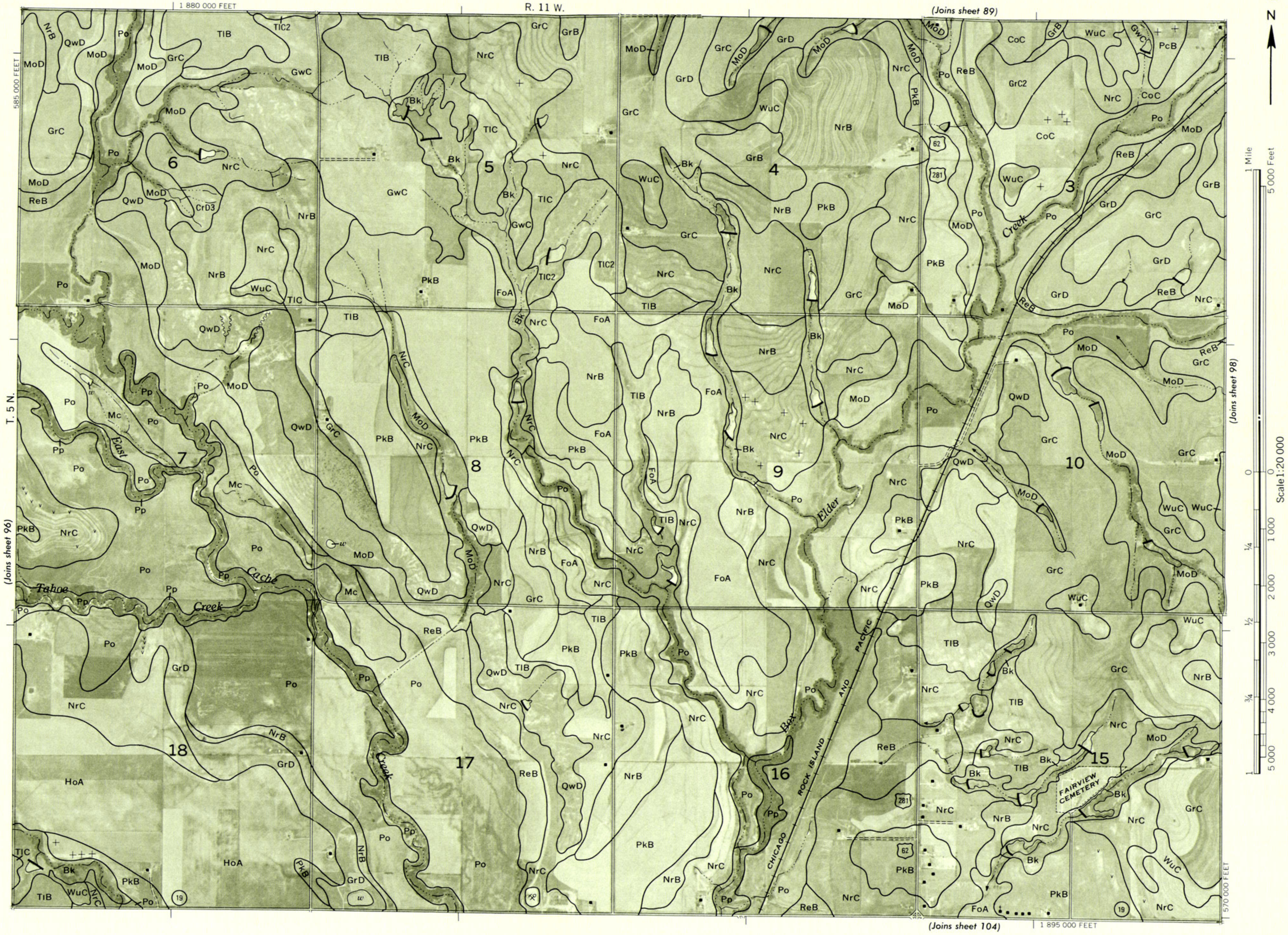
CADDO COUNTY, OKLAHOMA NO. 95

CADDO COUNTY, OKLAHOMA NO. 96

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 197 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.



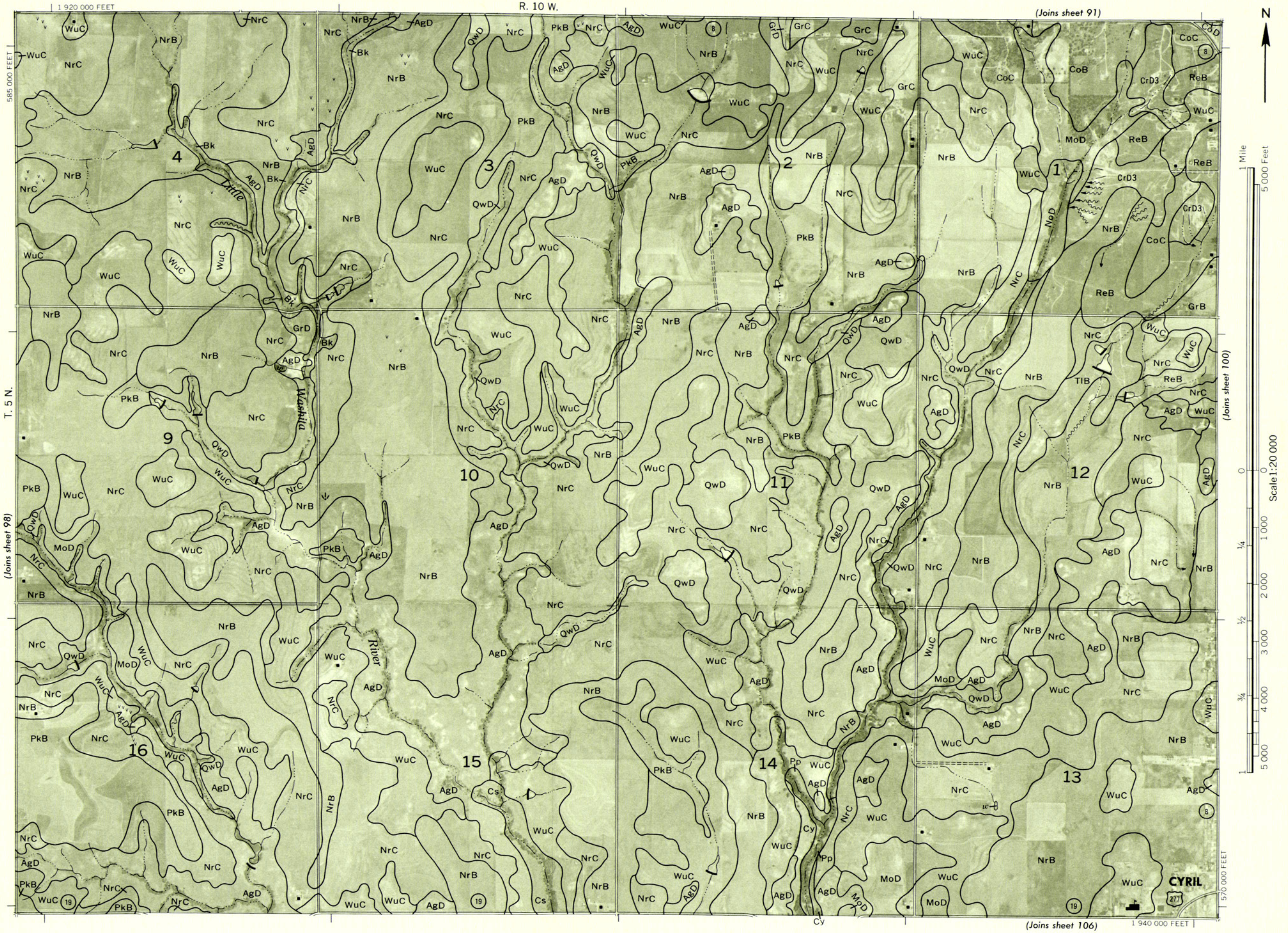
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.
Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.
Land division corners are approximately positioned on this map.

CADDO COUNTY, OKLAHOMA NO. 98

Land division corners are approximately positioned on this map.

Photobase from 1961 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Oklahoma coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Oklahoma Agricultural Experiment Station.



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